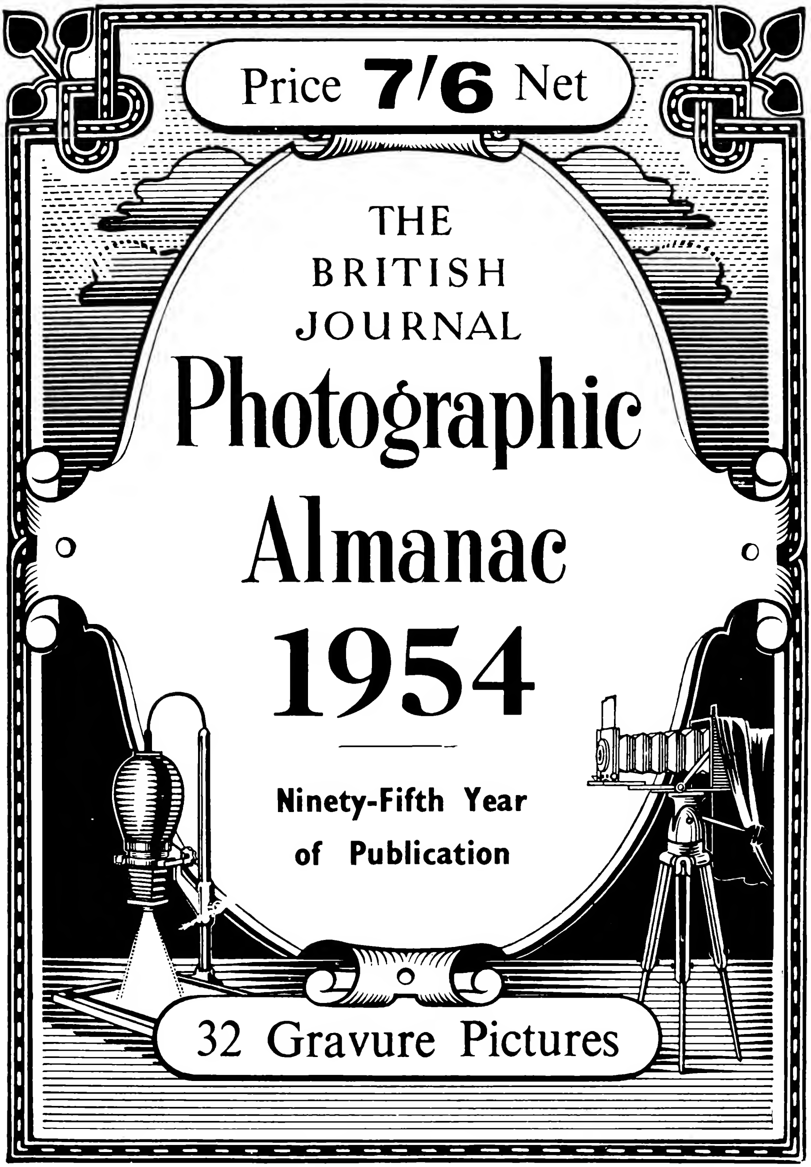
THE
BRITISH
JOURNAL

Photographic Almanac

1954



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Kodak Films

'Kodak' Films—the family name of a range of perfected emulsions, as diverse as photography itself. Famed for supreme reliability in professional, commercial and industrial studios . . . radiographic departments . . . photomechanical workrooms . . . motion picture studios . . . in the cameras of millions of amateur photographers . . . wherever and however photography is used.

In Roll Films '*Verichrome*', the fast ortho grade, is the popular snapshot choice; '*Panatomic*'-*X*, extra-fine-grain panchromatic, gives many-diameter grain-free enlargements; '*Plus-X*', fast fine-grain panchromatic, is the all-round, all-purpose film; '*Super-XX*', high-speed panchromatic, is recommended for artificial-light work.

In Sheet Films '*Super-XX*', '*Panatomic*'-*X*, and, for those who want a high-speed ortho film, '*Ortho-X*' are the leading materials.

As supreme in their field are 'Kodak' X-ray films; 16 mm. and 8 mm. reversal films for amateur movies; 16 mm. negative, positive and sound-recording films for narrow-gauge cinematography; recording films for oscillograph, seismograph and cardiographic work; 16 mm. and 35 mm. films for microfilming; and specialized films for motion picture work, the Graphic Arts, etc.

Kodak Plates

THE PRESSMAN'S 'SPECIAL'

Fastest plate in the world . . . daylight speed 38° . . . 500 plus. Clean-working. Evenly colour balanced. Low fog level. Gives excellent quality negatives. Ideal for flash; long gradation scale guards against 'soot and whitewash' effects.

P.2000

'Kodak' Press Special Plate

TOP FOR PORTRAIT AND GENERAL PHOTOGRAPHY

Daylight speed 34°. . . 200. Outstandingly long tone range. Remarkable fineness of grain for such high speed. The all-round plate for studio and outside work.

P.1200

'Kodak' Super Panchro Press Plate

Other 'Kodak' Plates include:

Blue-Sensitive
B.4, B.10, B.20, B.40

Orthochromatic
'KODALITH', O.250, O.800

Panchromatic
P.25, P.200, P.300, P.1500

Lantern Plates
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Scientific Plates
details on request

Kodak Papers

'Bromesko' Paper Supreme for print quality in portrait, industrial and pictorial photography. Outstandingly long tone range. Warm or black tones by direct development. Thirteen tint/surface/texture combinations.

'Kodak' Bromide Paper High-speed enlarging paper, made in a great variety of grades and surfaces; gives a cold black image. Special grades for Press and Air-Mail.

'Velox' Paper The 'Kodak' contact paper for industrial printing and D. & P. work. Rich blue-black tones. More amateur snapshots are printed on 'Velox' than on any other paper.

Other 'Kodak' Papers include '*Kovita*', warm-tone for de luxe portraiture; and a complete range of *Document-Copying Papers.* Of the latter, '*Kodak*' *Autopositive Paper* is the most widely useful; it has the outstanding characteristic of giving a direct positive print by normal development. By cutting out the negative stage, Autopositive saves both time and paper.

All non-tinted grades of 'Bromesko' and 'Kodak' Bromide Paper (except Press Bromide), and all 'Velox' and 'Kodak' Document-Copying Papers, are on the new 'whiter white' base.

Kodak Chemicals

MADE WITH INSIDE KNOWLEDGE

Who should know better than the world's foremost manufacturers of films, plates and papers, how to produce the finest processing chemicals? Kodak chemicals, liquid and powder, are rigorously tested for purity and fitness for purpose, and for use only need mixing or dissolving in water.

'Kodak' Universal Developer

Excellent liquid developer for films, plates and papers. Contains wetting agent and anti-fog constituent. Highly concentrated.

'Kodinol' Developer

Can be diluted up to 1+50 for negative materials. Equally suitable, at appropriate dilutions, for papers.

Other popular 'Kodak' Developers: 'Velox' Developer, Special Developer D.163, Press Contrast Developer, Time Standard Developer Powder, D.61a Negative Developer Powder, D.19b Developer Powder, 'Microdol' Developer Powder.

Other 'Kodak' chemicals include Fixing Salts and Hardeners, Toners, Wetting Agent, Anti-Fog Solution and Powder, White Ink, Opaques, and a complete range of raw photographic chemicals.

Kodak

Cameras for Professional Photographers

AN OUTSTANDINGLY VERSATILE CAMERA

This sturdily built $4\frac{3}{4} \times 6\frac{1}{2}$ inch stand camera has everything the professional, commercial, industrial or scientific photographer needs in the way of movements and fittings: rising and falling front, swing back, tilting front and back, quick-release back. Graduated scale on camera bed enables camera to be pre-set for taking pictures at fixed object/image ratios. 8-inch Kodak 'Ektar' Lumenized *f*/7.7 lens in flash-synchronized, 8-speed 'Epsilon' shutter.

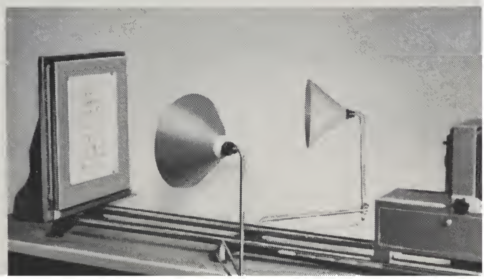
'Kodak' Specialist Camera Model 2

For the specialized needs of Clinical, Laboratory and Police photographers, this camera can be supplied with appropriate accessories. Details on request.

FOR COPYING DOCUMENTS, RADIOGRAPHS, TRANSPARENCIES, ETC.

A $4\frac{3}{4} \times 6\frac{1}{2}$ inch camera mounted on horizontal rails; easel mount supports copying board or transparency holder. Lens and shutter as on 'Kodak' Specialist camera (see above). An invaluable piece of equipment for hospital, laboratory and general workroom use.

'Kodak' Reduction & Copying Camera



Kodak

Cameras for Amateur Photographers

Most modern 'Kodak' and 'Brownie' cameras are flash synchronised. Fitted with the accessory 'Kodak' Flasholder, they can be used for snapshots indoors and at night as easily as in full sunshine. By prolonging indefinitely the amateur's 'day' these cameras are helping to revolutionize popular photography.

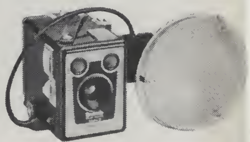
WORLD-WIDE SNAPSHOT SUCCESS

In brisk demand at home and overseas, the smartly styled Kodak 'Brownie' 127 has an eye-level viewfinder and press-button shutter release, and takes crisp pictures down to 5 ft. Eight pictures $1\frac{5}{8} \times 2\frac{1}{2}$ inches on 127 'Kodak' Film.

Kodak 'Brownie' 127 Camera

POPULAR BOX CAMERA GOES ONE BETTER

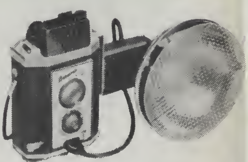
The Six-20 'Brownie' D has recently been restyled and fitted with flash contacts. This, plus its built-in close-up lens, makes it better-than-ever snapshot value. 8 pictures $2\frac{1}{4} \times 3\frac{1}{4}$ inches on 620 'Kodak' film.



Six-20 'Brownie' D Camera

PRINT-SIZE PICTURE PRE-VIEW

A hooded viewfinder, giving a clear view of the picture-to-be practically full size, is a popular feature of this camera. Flash contacts. Smooth press-button release. 12 pictures $1\frac{5}{8} \times 1\frac{5}{8}$ inches on 127 'Kodak' Film.

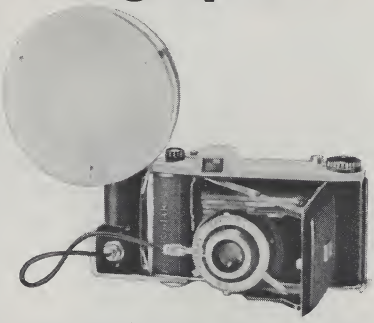


Brownie 'Reflex' Camera

Kodak

Cameras for Amateur Photographers

LATEST, SMARTEST,
QUICK-INTO-ACTION
FOLDING MODELS



These new Junior cameras open and lock in the 'taking' position at the touch of a button. Optical eye-level viewfinder. Model I: fixed focus lens and single-speed shutter. Model II: $f/6.3$ lens and two-speed shutter with flash contacts. Very handsome grey and black finish. Eight pictures $2\frac{1}{4}$ in. × $3\frac{1}{4}$ in. on 620 'Kodak' film. (Export only.)

'Kodak' Junior I and II Cameras

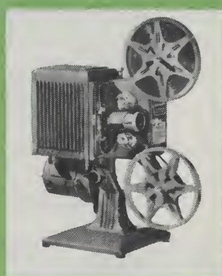
Other 'Kodak' cameras include Six-20 'Brownie' C and E*; Kodak 'Duaflex'*; Six-20 Folding 'Brownie' meniscus and $f/6.3$* lens; Six-20 'Kodak' A, $f/6.3$* and $f/4.5$* lens.

* *Flash contacts.*

'Economy team' for shooting and showing home movies

'Cine-Kodak' Eight-55 Camera

Easy to use as a 'Brownie' camera—just aim and press the button. 'Lumenized' $f2.7$ lens; eye-level viewfinder. Loads with 25 ft. of 8 mm. 'Cine-Kodak' film (returned after processing—which is done at no extra charge—as 50 ft. of film for projection).



'Kodascope' Eight-46 Projector

For sharp, brilliant screening of 8 mm. black-and-white or colour film. 200-watt lamp, $f1.6$ 'Lumenized' lens.

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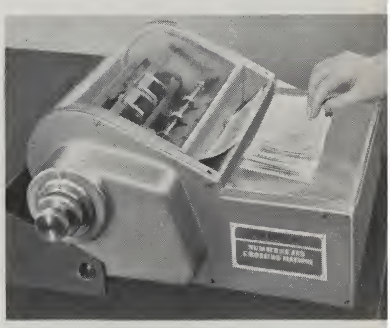
Used with the Commercial 'Recordak' machine, the '*Recordak*' *Numbering and Crossing Machine* enables cheques, statements and other documents to be numbered consecutively, crossed, date-stamped *and* microfilmed in one operation.



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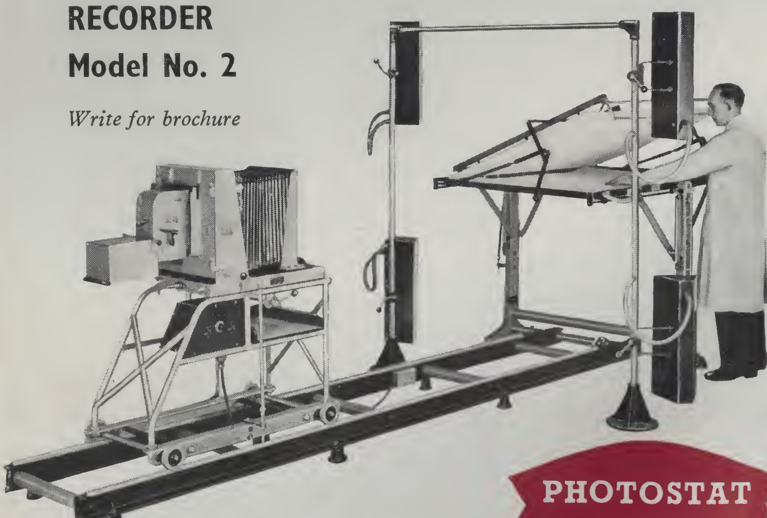

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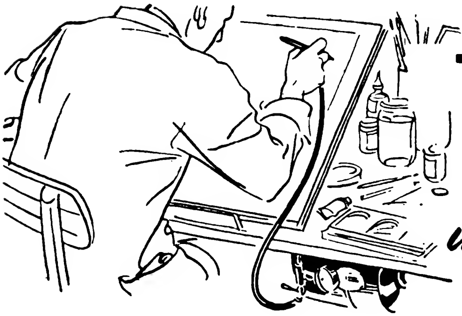

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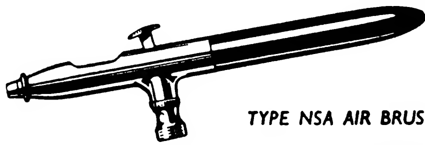

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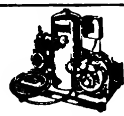

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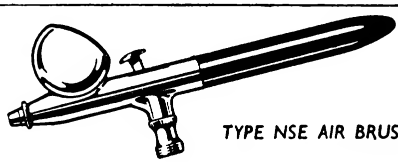
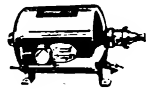


TYPE NSE AIR BRUSH



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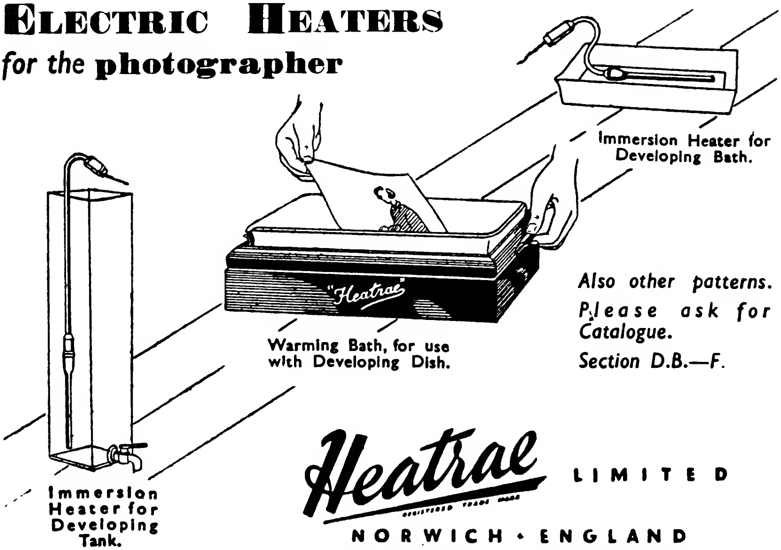

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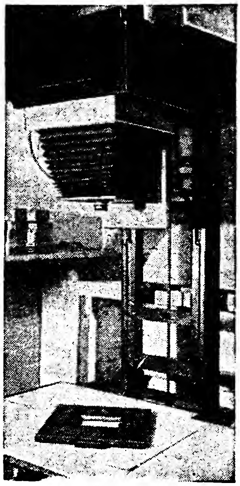

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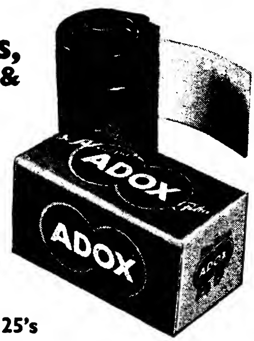

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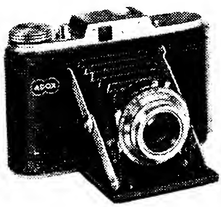

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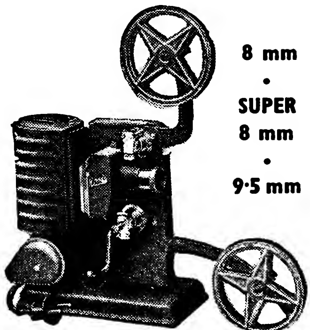
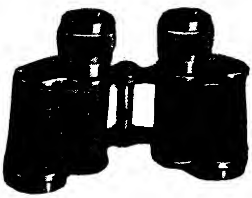


All NORIS Projectors are supplied in a handsome fibre-type carrying case.



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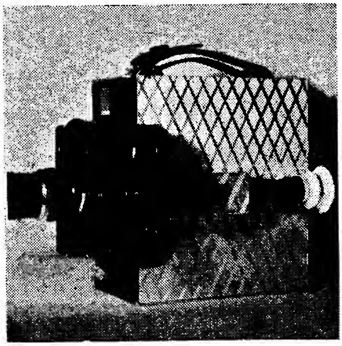

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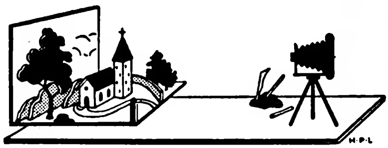

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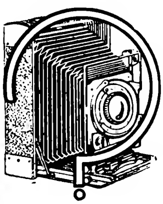

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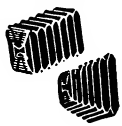

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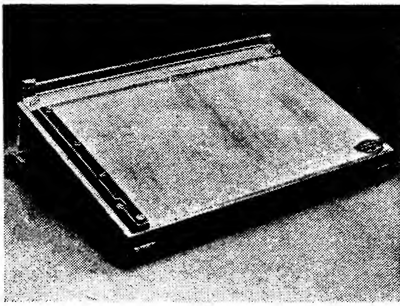
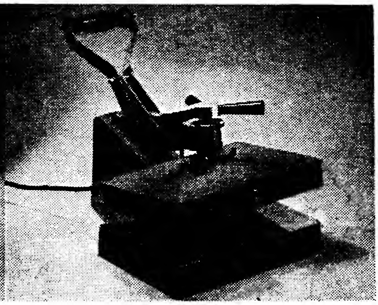


Merrett Desk Trimmer with 8, 11, 13, 16, 20, 24, 30, 36, 42, 48 or 54-*in. cut.*



Model "B" Press with 7½×10-*in. platen.*

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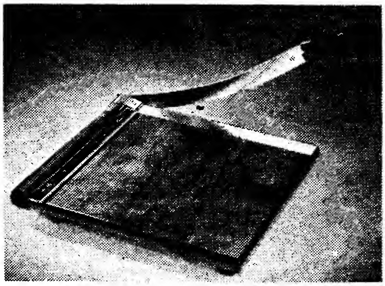
An exceptionally wide range of Merrett trimming equipment caters for every requirement of the professional photographer and the D. & P. works. Made to precision limits and equipped with inch or metric scales they ensure clean, accurate finishing of mounts, prints, maps, plans, etc.



Merrett Guillotine with 11, 13, 16 *or* 24-*in. cut.*

Merrett Desk Trimmer, in sizes from 8 in. to 54 in. cut, is suitable for all print trimming—from small photographs to large display pieces. The large trimmers—24 in. to 54 in.—can be supplied complete with a treadle and tubular steel framework to operate the cutting blade. Merrett Guillotine is suitable for cutting card of various thicknesses, as well as paper. The specially shaped spring blade gives a clean, easy cut, and clips level with the baseboard for safe storage. The sizes range from 11 in to 24 in. cut. A 24 in. Guillotine with clamp is now available.

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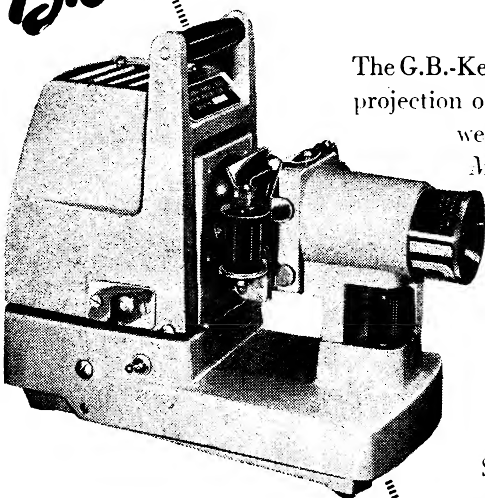

The G.B.-Kershaw K250 gives brilliant projection of colour transparencies as well as filmstrips and slides. *Main Features:* All lenses hard coated. Instantly interchangeable film and slide carriers. 2 picture sizes (18 x 24 mm and 24 x 36 mm) on standard 35 mm film. Built-in mains switch. Robust construction—Simple operation. Sturdy carrying case accommodates projector, film and slide carriers, extra lenses and all accessories.

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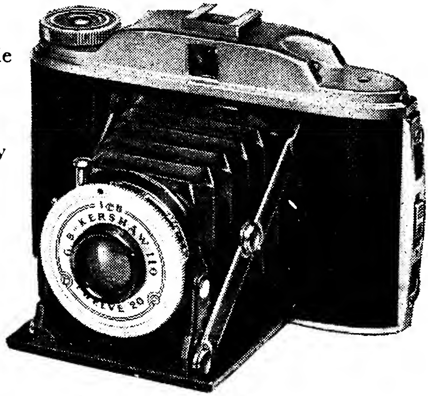

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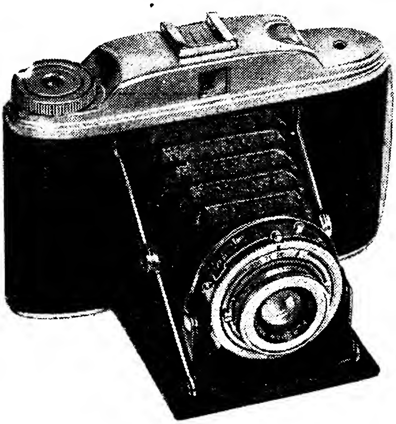

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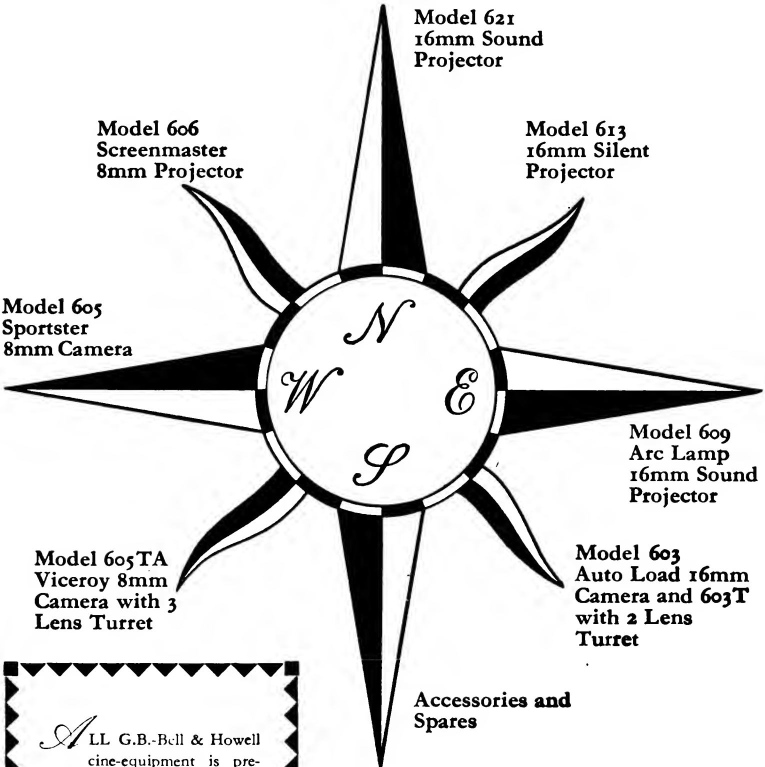

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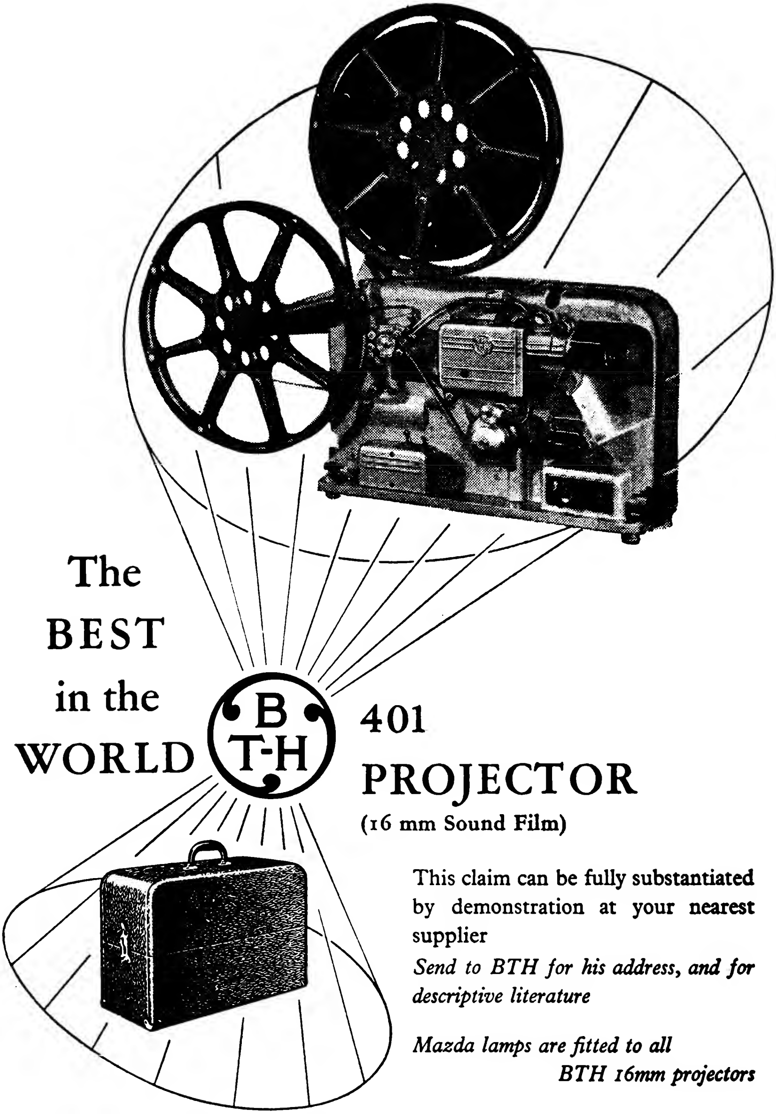

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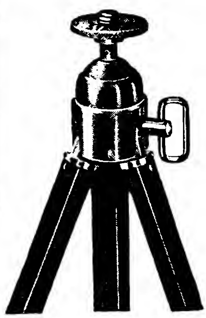

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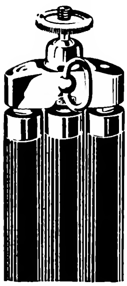

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(Illustrated left)

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Also Model 1017, equipped with built-in ball-and-socket head easily locked by an eccenter locking device. Closed 9½", extended 43½", weight 6½ oz. (also in brass as 2027).

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You will like the BELLA at first glance! It is elegant, smart and slim and so simple to use that even a novice will be able to obtain first class black and white or colour pictures.

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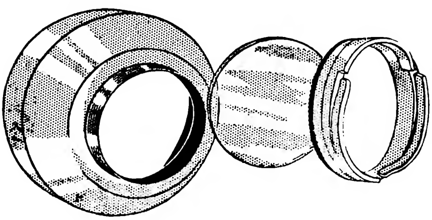
THE "3-SPRING ADJUSTABLE" FILTER HOLDERS

With a reputation of long standing, this type of holder serves the purpose of covering with each size of holder variations of lens mount diameters of 3 mm., so that practically any lens mount between 18 and 45 mm. is covered by the nine sizes available. It is now also provided with 3 SPRINGS permitting CENTRAL FITTING on to the lens mount. Strongly constructed in BRASS chromium-plated.



Holder Size		*Holder Size*	
18/20	(19 mm. glass)	29/32	(31 mm. glass)
20/23	(22 mm. ,,)	33/36	(35 mm. ,,)
22/25	(25 mm. ,,)	37/40	(38.5 mm. ,,)
25/28	(28 mm. ,,)	40/43	(41 mm. ,,)
		43/45	(41 mm. ,,)

A lenshood having the same thread as the front element of the filter holder may be supplied in each case, this being fitted in place of the filter retaining ring, thus forming a combined holder and lenshood of very sturdy construction. (*As illustrated*)

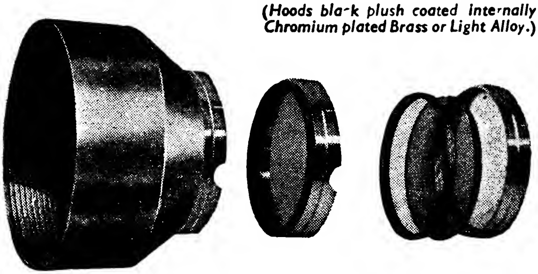
THE "COMPACT" FILTER HOLDER

(with sunk retaining ring)

A more simplified pattern of holder which may readily be fitted with all colours of filter glasses and Supplementary Lenses. Despite their surprisingly low prices, enabling most amateurs to purchase a complete set of mounted filters for immediate use, these ACTINA holders are extremely well finished in BRASS chromium plated. They are initially supplied complete with either filter glass or a Supplementary Lens, but nevertheless also allow for interchange by unscrewing the blackened sunk front. Their availability in 16 sizes meets the demand for push-on filters to fit practically any existing type of camera.

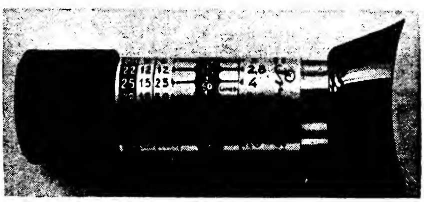
Compact Holder size	*Takes Filter Glass or Supplementary Lens size*
22 mm.	19 mm.
23 mm.	21 mm.
24 mm.	22 mm.
25 mm.	22 mm.
27 mm.	25 mm.
28 5 mm.	25 mm.
29 mm.	26 mm.
30 mm.	28 mm.
31 mm.	28 mm.
32 mm.	28 mm.
33 mm.	31 mm.
34 mm.	31 mm.
36 mm.	33 mm.
37 mm.	35 mm.
38 mm.	35 mm.
42 mm.	38 mm.

(Hoods bla-k plush coated inte-nally Chromium plated Brass or Light Alloy.)



"PUSH-ON" HOODS are available in each size to fit on the front of these holders, or directly on to the lens mount.

"PRACTOS" FOR VISUALLY DEFINING YOUR EXPOSURE!



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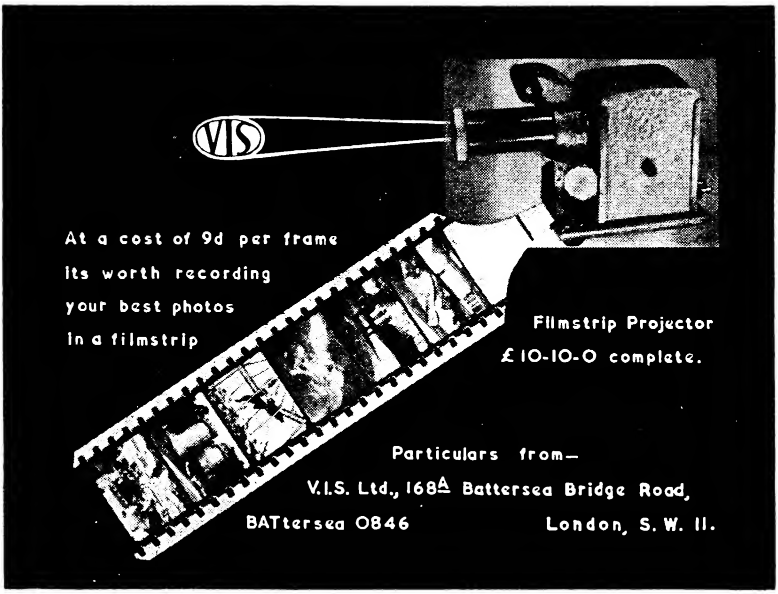

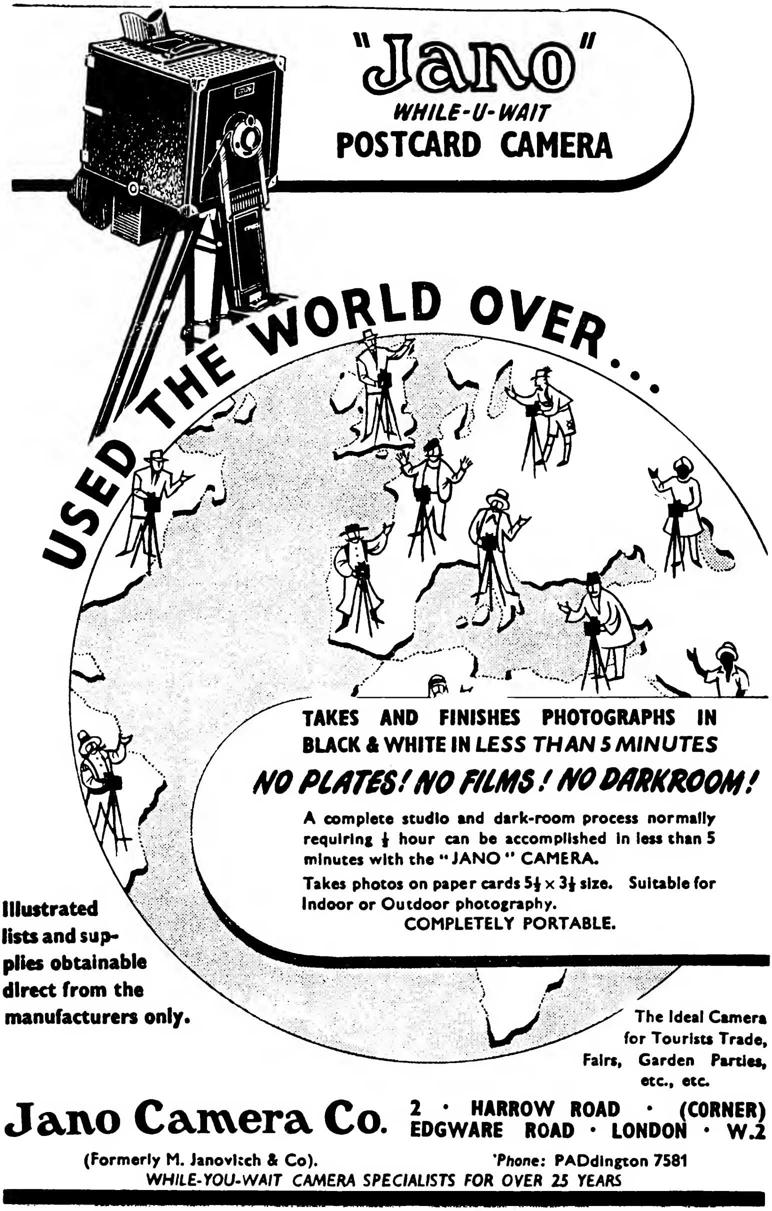
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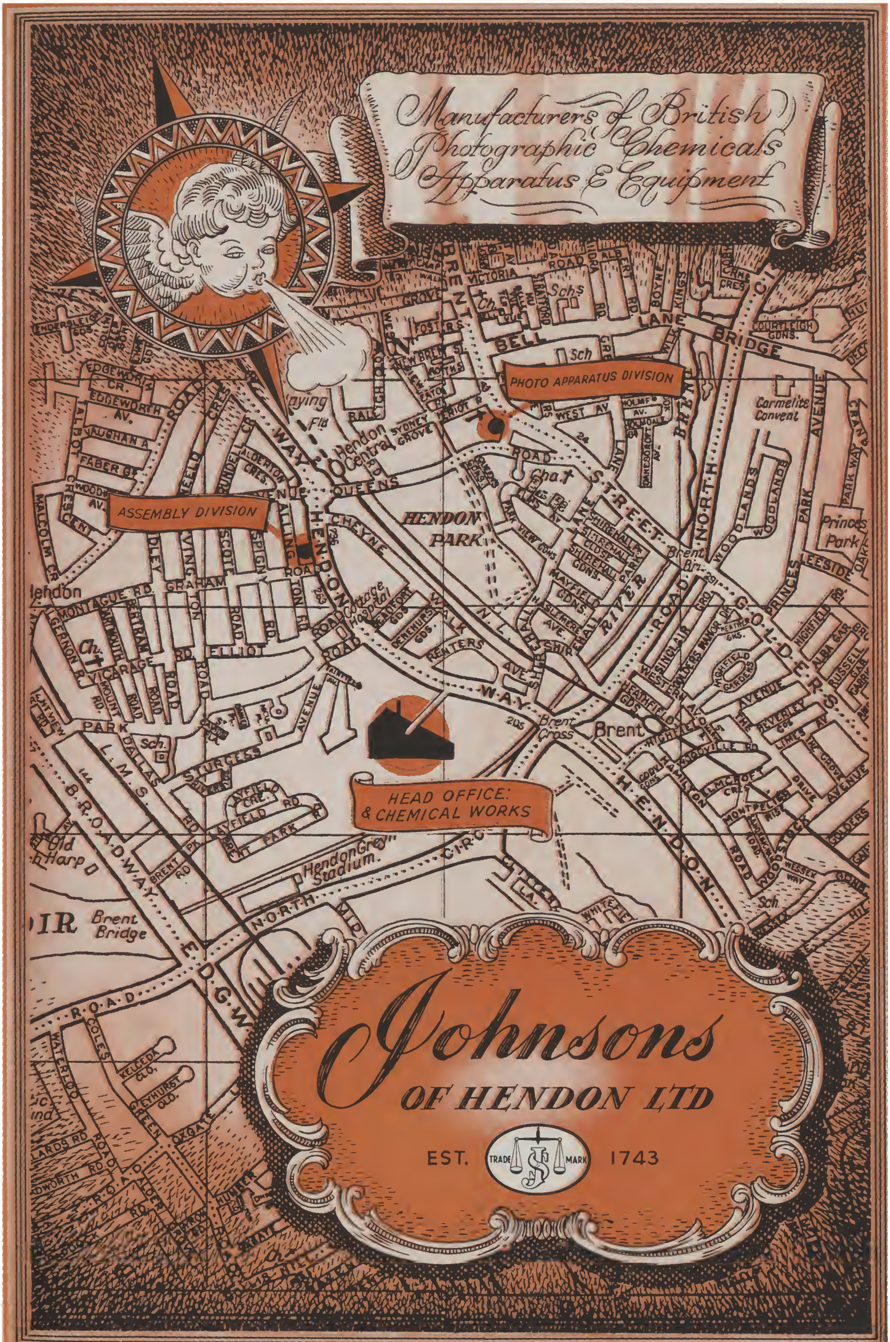
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THE COLOUR SCREEN OUTFIT contains everything required for experimenting with this simple and interesting additive process. (Booklet on request.)

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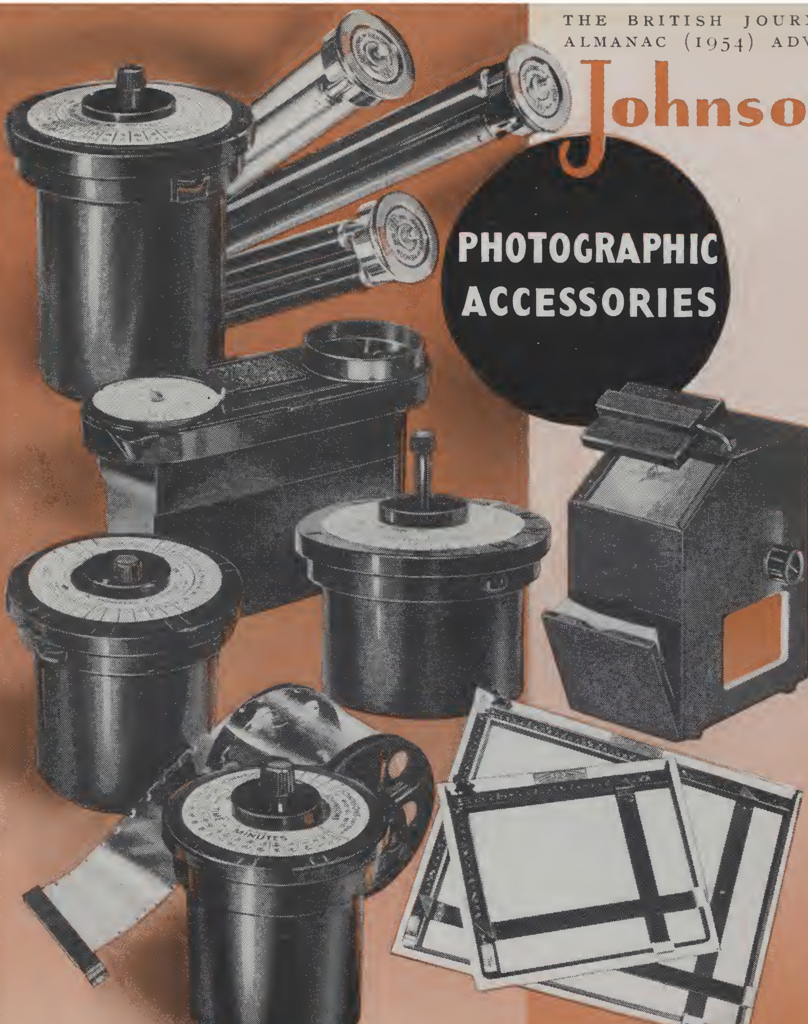

One of the most important accessories in any darkroom is the developing tank and the Johnson range of tanks, backed by many years of experience in their manufacture, are acknowledged to be among the world's best. J-20 takes all 120/620 films; UNIVERSAL ADJUSTABLE from size 116 down to 16 mm.; APRON, 120, 127 or 116; 35 mm., a full-length 35 mm. and the CUTPLATE is adjustable for flat films and plates in all sizes up to 5×4 in. Other accessories illustrated above are ENLARGING PAPER HOLDERS (Masking Frames) and the EXACTUM CONTACT PRINTER.

Johnson

The Johnson range of Darkroom Accessories covers every possible item that both Commercial and Amateur users will need. Special attention has been given to the beginner's requirements with the Johnson Home Photography Outfits which have been outstandingly successful in giving many thousands a chance to start for a very moderate outlay. Inexpensive Flash outfits include No. 1, complete with 4 flashbulbs and clip-on reflector, and the new Model O Capacitor Flashgun. A new model of the Exactum Postcard Enlarger makes postcard size prints from 35 mm. (24 × 36 mm.) negatives.

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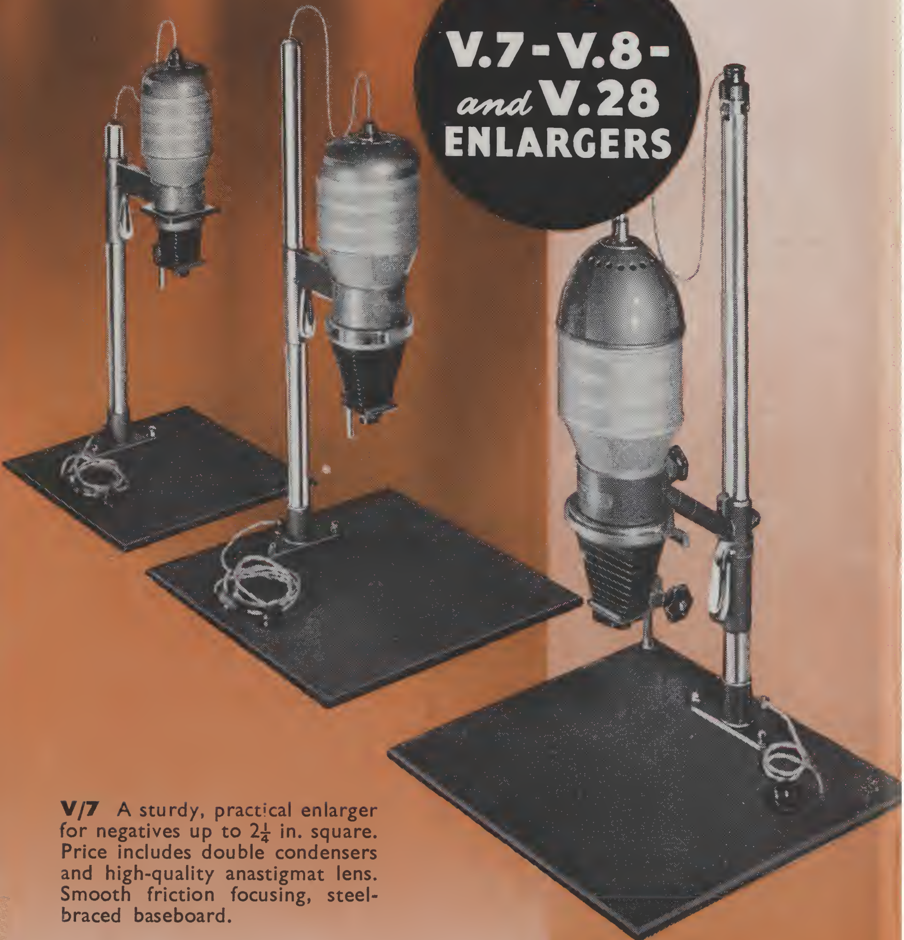
V.7 - V.8 - *and* V.28 ENLARGERS



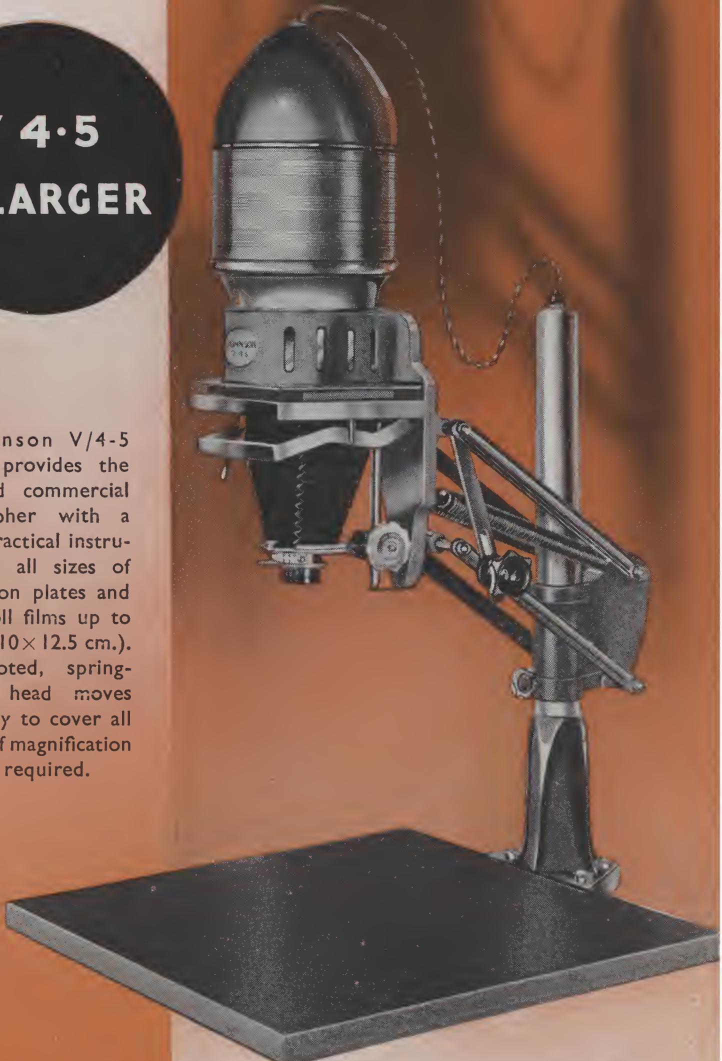
V/7 A sturdy, practical enlarger for negatives up to $2\frac{1}{4}$ in. square. Price includes double condensers and high-quality anastigmat lens. Smooth friction focusing, steel-braced baseboard.

V/8 Similar design to V/7 for $2\frac{1}{4} \times 3\frac{1}{4}$ in. negatives. Double condensers, anastigmat lens. Both models have convenient clamp clutch for one hand raising and lowering of head.

V/28 For $2\frac{1}{4} \times 3\frac{1}{4}$ in. (6×9 cm). Counterbalanced head (which can also be turned horizontally) held by quick-release clamp. Supplied fitted for Tungsten or Mercury Vapour illuminant. 2 in. (50 mm.), 3 in. (75 mm.) or 4 in. (100 mm.) lenses can be supplied. Illustrated Brochures on request.

Johnson

V 4·5 ENLARGER



The Johnson V/4-5 Enlarger provides the press and commercial photographer with a sturdy, practical instrument for all sizes of negative on plates and flat or roll films up to 4×5 in. (10×12.5 cm.). The pivoted, spring-balanced head moves effortlessly to cover all degrees of magnification normally required.

Large lamphouse with adjustable lamp position for Tungsten or M.V. is ventilated by air ducts. 7 in. optically polished condenser gives perfectly even illumination, high speed and finest contrast. Dallmeyer f/4.5, 6 in. (150 mm.) focus lens normally supplied but enlarger will also accommodate lenses down to 2 in. (50 mm.) in quickly interchangeable mounts.

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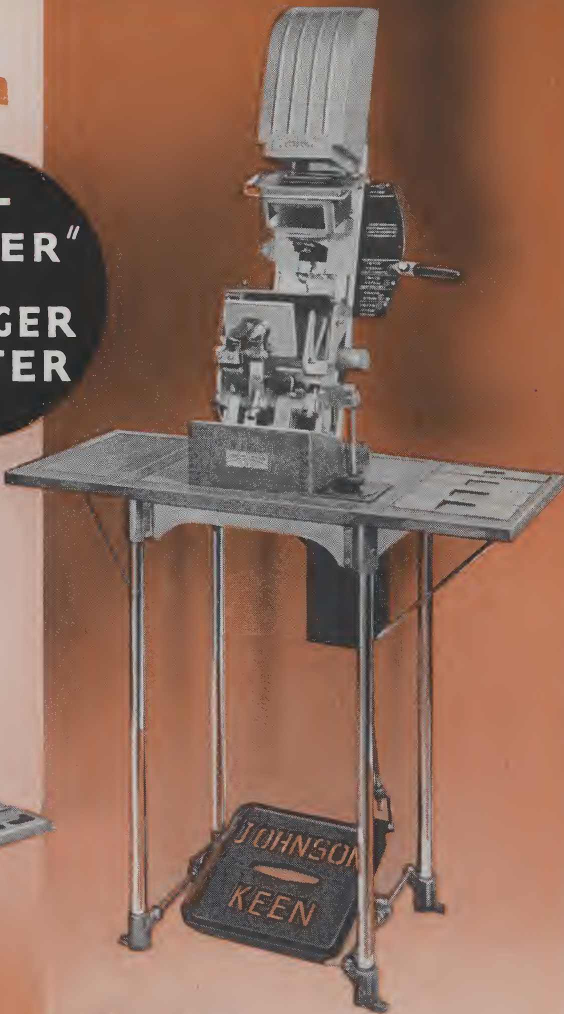
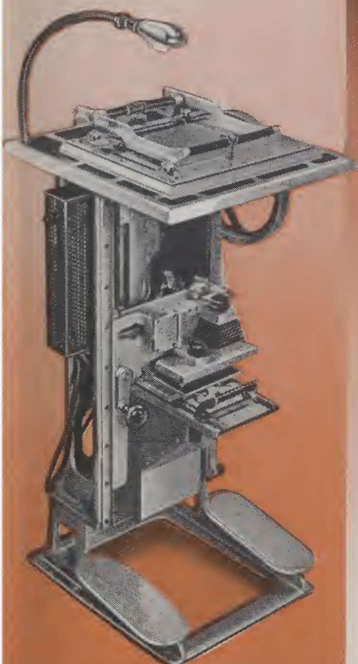


ENLARGER PRINTER

Twin lenses, 2 in. and 4 in., both with automatic focusing. Enlarges up to $6\frac{1}{2} \times 8\frac{1}{2}$ in. or 18×24 cm. from all negatives 35 mm. to $2\frac{1}{4} \times 3\frac{1}{4}$ in. (6×9 cm.).

Brochure on request.



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'EN-PRINTER'

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Brochure on request.

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SUPER GLOSS DRYERS

The design of the Johnson Super Gloss Dryers is based on a lifetime of experience in the perfect drying and glazing of photographic papers. Their high efficiency and performance has been tested by years of practical use in the largest photo-finishing establishments in the world.

Model 35. Output 750 $2\frac{1}{2} \times 3\frac{1}{2}$ in. (6×9 cm.) prints per hour. Drum : diameter 17 in. (425 mm.), width 16 in. (400 mm.).

Model 38 (*above*). Output 1,250 prints per hour. Drum : diameter $22\frac{1}{2}$ in. (565 mm.), width 19 in. (482 mm.).

Model 55. Output 2,000 prints per hour. Drum : diameter 24 in. (600 mm.), width 24 in. (600 mm.).

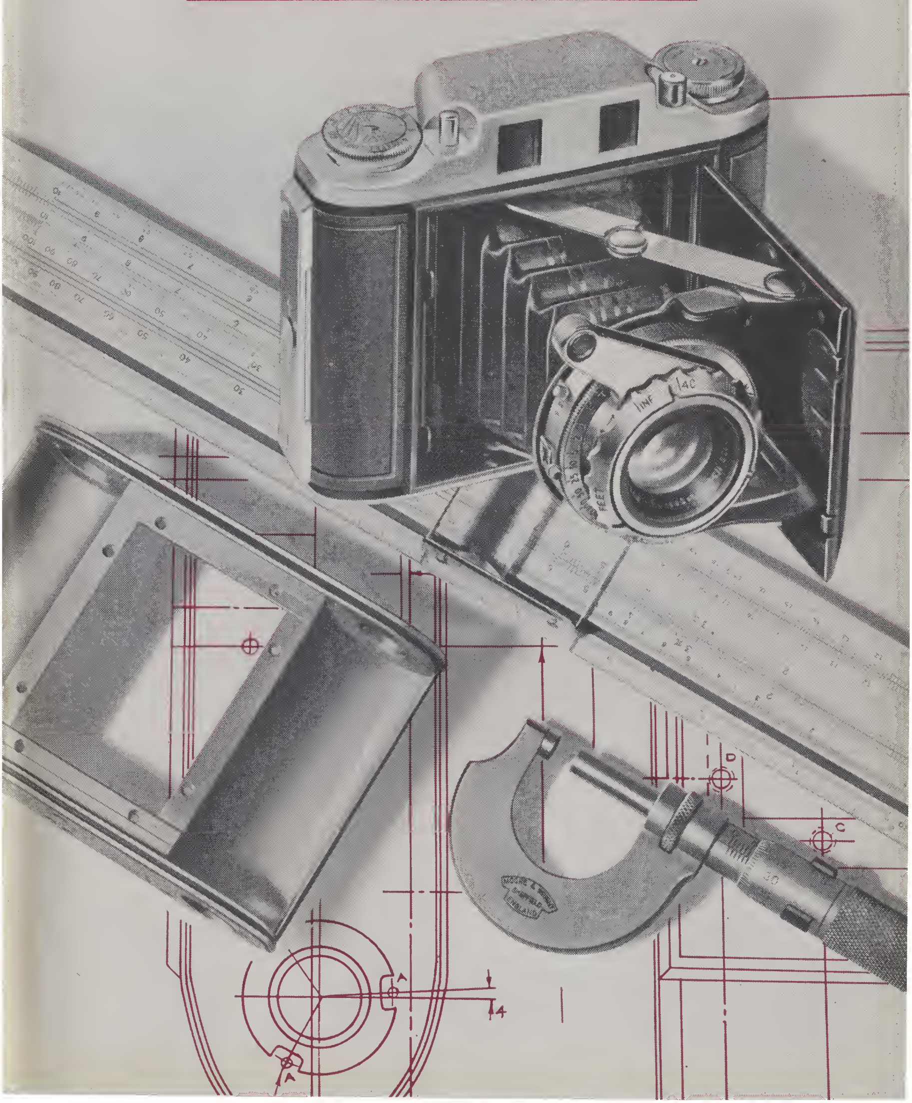
Fully descriptive brochures and prices on application.

JOHNSONS OF HENDON LIMITED

HENDON LONDON ENGLAND

ROSS ENSIGN

DESIGNERS REPORT



ROSS ENSIGN

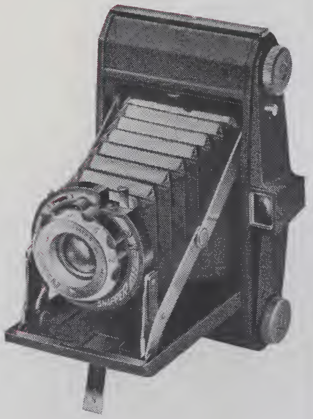
CAMERAS

DURING the last few years no photographic development has been so outstanding as the ascendancy of Ross Ensign products and proof of this claim will certainly be found in the latest range of cameras and accessories.

Britain has unique design and manufacturing facilities in the Ross Ensign factories, which contribute two notable benefits to their photographic products.

First, greatly improved optical and mechanical design, which only combined planning at the drawing board stage can ensure.

Second, the benefits of precision engineering, allied to rigid control of optical performance, which only specialist manufacturers can exercise over their products.



The Snapper is the ideal first folding camera for the beginner. The model illustrated is fitted with a lens in a focusing mount, optical viewfinder and synchro-flash contacts. Models with alternative combinations of lens and shutter will be available shortly.

All Ross Ensign products have been planned to the very last detail, a notable example being that any part required for servicing may be obtained by reference to the " Ensign Service Manual " which is in the possession of

A folding viewfinder hood, swing cradle loading chamber and pressure die-cast body are some of the new and exclusive features of the 1954 Ful-Vue Super Camera.

every leading photographic dealer at home and abroad. It includes a service diagram from which any tiny component can be identified and renewed if ever necessary.

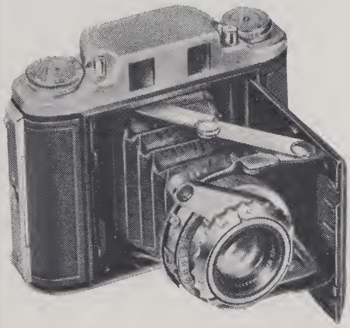
The specifications of this year's cameras show a clear understanding of the requirements expressed by the majority of keen photographers and a practical endeavour to provide good value within a reasonable price range.

The most interesting news item is that an entirely original Ful-Vue is on its way. Known as the Ful-Vue Super, it will incorporate all the improvements and new features suggested by the manufacture of over a million of these cameras since the last model was introduced. The Ful-Vue Super will be the finest twin-lens box camera ever offered to the public.

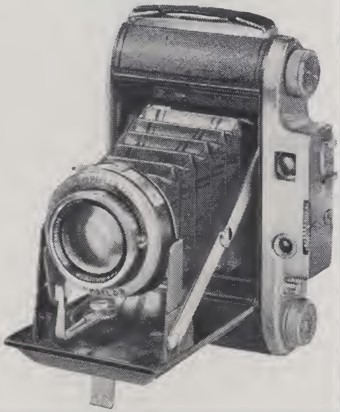
The Snapper, also, will soon be available with different combinations of lens and shutter. It will offer the beginner and the enthusiast alike ideal equipment for photography under varied lighting conditions.

Other Ross Ensign miniatures will include the Selfix 16-20 and 12-20 series of cameras with Rosstar or Ross Xpres lenses, which are already firm favourites.

At the other end of the scale, such cameras as the Selfix 820 Special and the Autorange 16-20 will provide the experts with high-class photographic instruments which will do justice to their greater experience and skill.



The Autorange 16-20 fitted with 75mm. Ross Xpres f/3.5 lens still holds its own as Britain's most distinguished coupled rangefinder camera. A unique feature of this model is the combination of rangefinder and Albada viewfinder.



The Selfix 820 Special has a built-in rangefinder and takes either twelve 2¼in. square or eight 2¼ x 3¼in. pictures on 120 or 620 roll film. The 105mm. Ross Xpres f/3.8 colour corrected and coated lens makes it an excellent model for amateur and professional alike.

ROSS
LONDON

LENSES

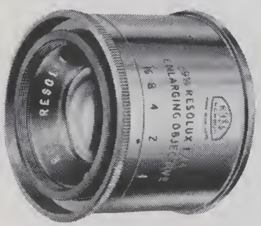
ROSS specialise in the construction of optical goods for every purpose and a wide range of lenses is available to manufacturers of photographic equipment, professional photographers and scientific workers in every field.

This 5in. Ross Xpres wide angle lens in Epsilon shutter is one of the special objectives designed for use in view cameras such as the M.P.P. and the Speed Graphic.

For well over a century an insistence on the highest possible standards of workmanship has been maintained. Since the earliest days of photography, camera manufacturers have recognised the superb quality of Ross lenses and users have come to accept the name of ROSS as synonymous with excellence in optical performance. The R.A.F., colonial and foreign Governments and the leading commercial survey companies also insist on Ross lenses for aerial survey and reconnaissance.

In the following pages the most popular standard Ross lenses are listed and as will be seen from the tables, many of the professional lenses can now be supplied in flash synchronised shutters.

Enquiries are also welcomed for a variety of optical instruments including precision equipment for lens and instrument testing.



One of the Ross Resolux lenses specially computed for enlarging negatives up to $2\frac{1}{4}$ x $3\frac{1}{4}$in.

ROSS XPRES F/4.5 SERIES

Focal length		Field covered	Flange	Mount
in.	nominal		in.x24 t.p.i.	
6	152 mm.	4 x 5 in. or 9 x 12 cm.	$2\frac{1}{8}$	* Focussing
$7\frac{1}{4}$	184 mm.	$4\frac{3}{4}$ x $6\frac{1}{2}$ in. or 12 x 16 cm.	$2\frac{1}{8}$	* Iris
$8\frac{1}{2}$	216 mm.	5 x 7 in. or 13 x 18 cm.	$2\frac{1}{2}$	* Iris
10	254 mm.	$6\frac{1}{2}$ x $8\frac{1}{2}$ in. or 18 x 24 cm.	$2\frac{7}{8}$	* Iris
12	305 mm.	8 x 10 in. or 20 x 25 cm.	$3\frac{1}{2}$	* Iris
14	356 mm.	10 x 12 in. or 25 x 30 cm.	$4\frac{1}{4}$	Iris

ROSS LENSES IN EPSILON SHUTTERS

Focal length		Type and aperture	Shutter speeds	Maximum field covered
nominal	mm.			
3 in.	75	Rosstar f/4.5	4 or 8	$1\frac{5}{8}$ x $2\frac{1}{4}$in. or 4.5 x 6 cm.
3 in.	75	†Ross Xpres f/3.5	4 or 8	$1\frac{5}{8}$ x $2\frac{1}{4}$in. or 4.5 x 6 cm.
$3\frac{1}{16}$ in.	77.5	Ross Xpres f/3.5	8	$2\frac{1}{4}$ x $2\frac{1}{4}$in. or 6 x 6 cm.
4 in.	105	†Rosstar f/4.5	4 or 8	$2\frac{1}{4}$ x $3\frac{1}{4}$in. or 6 x 9 cm.
4 in.	105	†Ross Xpres f/3.8	4 or 8	$2\frac{1}{4}$ x $3\frac{1}{4}$in. or 6 x 9 cm.
5 in.	127	Ross Xpres f/4.5 W.A.	8	4 x 5 in. or 9 x 12 cm.

ROSS XPRES F/4 WIDE ANGLE SERIES

Focal length		Field covered at f/4	Flange	Mount
in.	nominal		in. x 24 t.p.i.	
4	102 mm.	4 x 5 in. or 9 x 12 cm.	$1\frac{1}{2}$	* Iris
5	127 mm.	4 x 5 in. or 9 x 12 cm.	$1\frac{3}{4}$	* Iris
6	153 mm.	$4\frac{3}{4}$ x $6\frac{1}{2}$ in. or 12 x 16 cm.	2	* Iris
$8\frac{1}{4}$	210 mm.	7 x 9 in. or 18 x 24 cm.	$2\frac{1}{2}$	* Iris
10	254 mm.	8 x 10 in. or 20 x 25 cm.	$3\frac{1}{8}$	* Iris

ROSS HOMOCENTRIC F/6.3 SERIES

Focal length		Field covered	Flange	Mount
in.	nominal		in. x 24 t.p.i.	
7	178 mm.	$4\frac{3}{4}$ x $6\frac{1}{2}$ in. or 12 x 16 cm.	$1\frac{5}{8}$	* Iris
$8\frac{1}{2}$	216 mm.	5 x $7\frac{1}{2}$ in. or 13 x 18 cm.	$1\frac{7}{8}$	* Iris
10	254 mm.	$6\frac{1}{2}$ x $8\frac{1}{2}$ in. or 18 x 24 cm.	$2\frac{1}{8}$	* Iris
12	305 mm.	8 x 10 in. or 20 x 25 cm.	$2\frac{1}{2}$	* Iris

* These lenses are also supplied in Compur or Compound shutters to special order.

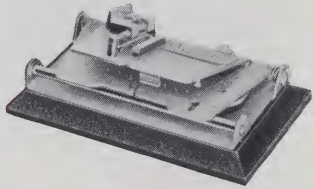
† Denotes front cell focussing.

ROSS ENSIGN ACCESSORIES

THE range of accessories for Ross Ensign equipment includes leather slip-in and ever-ready cases for the entire range of cameras.

A standard flash unit is also available, suitable for use on any camera fitted with synchroflash contacts. This unit may be attached to the camera by means of a bracket which is provided, or mounted on a tripod for use at a distance from the camera position.

The Ross Ensign Standard Enlarger provides the ideal home equipment for every keen photographer. It will take negatives up to $2\frac{1}{4}$ x $3\frac{1}{4}$in. and has a coated f/4.5 lens specially designed for enlarging. Prints up to 15 x 12in.



The Ross Ensign Universal Splicer. An all-purpose model suitable for editing any type of narrow gauge cinematograph film.

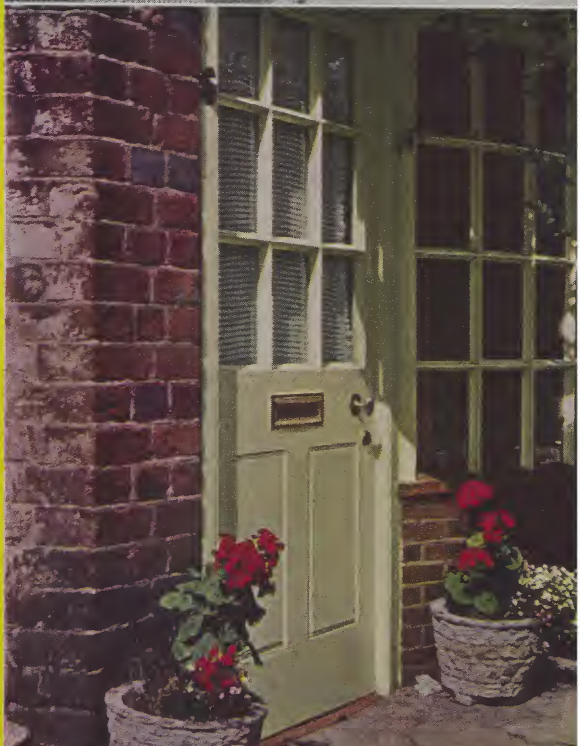
Standard Enlarger with f/4.5 coated projection lens for negatives up to $2\frac{1}{4}$ x $3\frac{1}{4}$in.

can be made on the baseboard and larger prints can be produced by rotating the lamphouse on the column.

For the cine enthusiast, Ross Ensign Universal and Popular Splicers cover every size of narrow gauge film. With the Universal model any narrow gauge film can be handled on the same instrument, while the Popular model provides a single purpose splicer for either 8mm., 9.5mm., or 16mm. film.

Ultrachrome film is available in sizes to fit any Ensign camera and its wide latitude combined with fine grain will ensure excellent results from miniature negatives.

ILFORD

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ILFORD

PAPERS

Bromide

Ilford Bromide paper gives prints of a true black image colour. An extremely wide range of surfaces and a choice of up to five evenly spaced contrast grades caters for every type of subject and negative.

Plastika

Ilford Plastika is a special enlarging paper which produces prints of a beautiful warm-black image colour. The easiest of all papers to handle, it possesses exceptional latitude in exposure and development and is supplied in nine different surfaces.

Multigrade

Ilford Multigrade paper provides the means of printing all types of negatives from one box of paper. With a set of three yellow filters of increasing depth, a range of four distinct contrast grades can be obtained. Made in two surfaces, Glossy and Velvet Stipple.

Contact

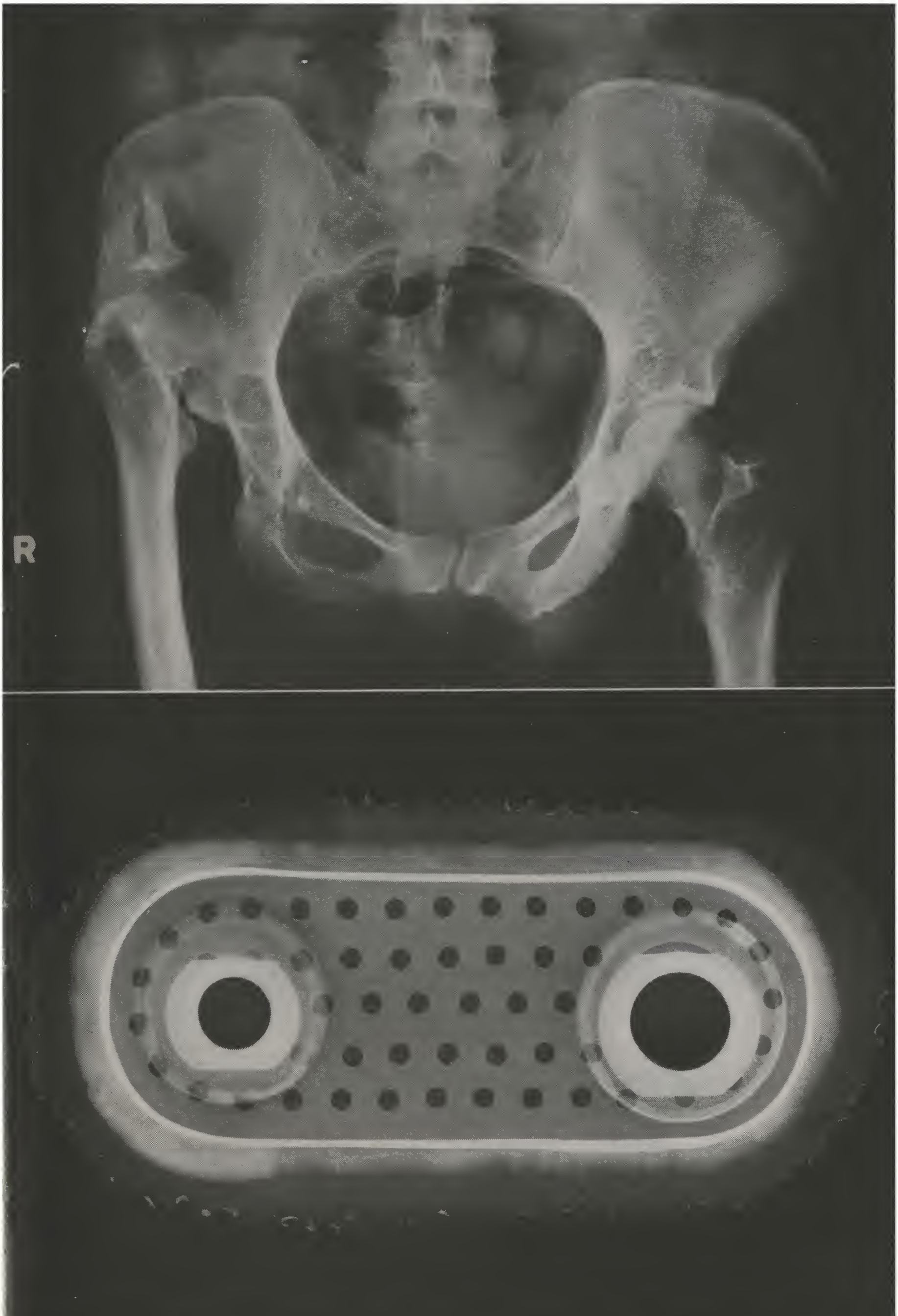
Ilford Contact paper gives prints of a pleasing blue-black image colour and is supplied in two different surfaces. It possesses great latitude in exposure and development, and is completely resistant to fog and stain on prolonged development.

Document

Ilford Document papers are made in many different varieties for copying drawings, plans, and all kinds of written or printed matter by any of the established photographic methods, including reflex printing and photography in special document copying cameras.

Above: Negative by Ronald Traube *on Ilford HPS flat film.*

Below: S.S. United States. *Negative by* R. G. Lock, *A.R.P.S., on Ilford HP3.*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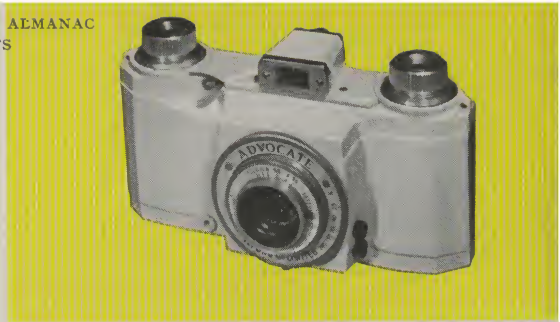
ILFORD

ACCESSORIES

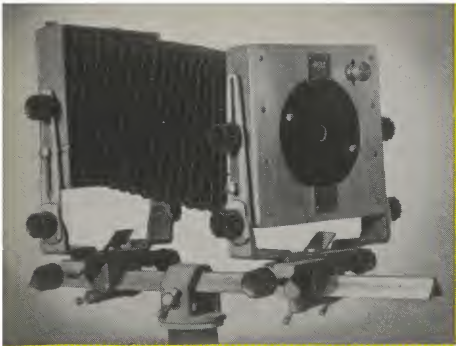


Advocate 35 mm Camera

A modern miniature camera with a bloomed Dallmeyer *f*/3·5 anastigmat lens of 35 mm focal length. The lens gives remarkable depth of field and has an unusually wide angle of view which is invaluable in confined spaces. Aperture, focusing, and shutter speeds are controlled by three concentric rings encircling the lens mount. Built-in contacts are provided for use with flash guns.

Premier Film Joiners

These precision-built film joiners incorporate the standard toothed scraper and give a $\frac{3}{32}$ in. overlap. The de luxe model is designed for both 16 mm and 8 mm film. A universal model is available for use with 9·5 mm film as well as 16 and 8 mm.



4 × 5 Monorail Camera

A studio camera of contemporary design embodying the comparatively new monorail carriage principle. It is fitted with every type of movement which may be required in Commercial, Industrial, Medical, and Scientific photography. Precision-built and beautifully finished.

Envoy Junior Enlarger

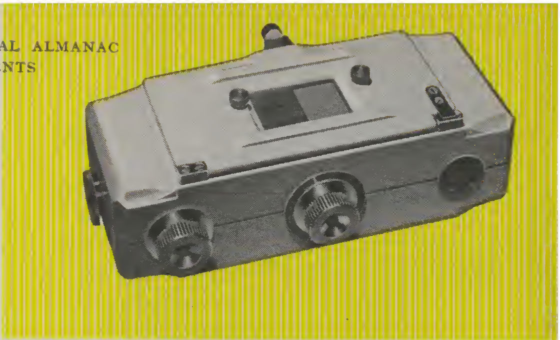
A low priced, yet efficient amateur enlarger taking negatives from 35 mm up to $2\frac{1}{2} \times 3\frac{1}{2}$ in. The basic model employs an opal diffuser, but condensers may be fitted if preferred. The baseboard allows for enlargements up to 12×15 in. to be made.

Rollhead Printer

A fully automatic printer for the busy D & P department, capable of delivering 600 prints per hour. Negatives are printed on one grade of paper from the roll, and exposures are determined automatically.

D. & P. Print Washer

A print washer designed to take 300 $2\frac{1}{2} \times 3\frac{1}{2}$ in. prints at one loading. An inner galvanised mesh container permits of quick draining and removal of the washed prints preparatory to glazing.



ILFORD

ACCESSORIES

Film Strip Printer

A compact printer for preparing 35 mm film strips either by contact or projection. It holds up to 10 ft of film on the feed spool and is designed to enable the sequence of frames on the negative to be altered and also sections from different negatives to be printed on the same strip. Supplied with two masks – full frame and half frame sizes.

High Intensity Industrial Viewing Lantern

Employs a high intensity sodium vapour lamp for the easy interpretation of high density radiographs frequently met with in industrial work. Consumption is only 140 watts. Full viewing area is 15 × 6 in. but built-in masks permit smaller film sizes to be inspected.

Studio Spotlight

A focusing spotlight using a 500-watt bulb and fitted with a specially designed prismatic condenser. Maximum height when extended is 6 ft 9 in. and for low-angle pictures the lamphouse can be mounted on the stand base. Supplied with 40 ft of cable.

X-ray Viewing Lantern Type 6

Upright pattern for 14 × 17 in. films. This very low-priced lantern gives brilliant illumination with four 40-watt bulbs. Four clips are fitted to hold dry films and a perspex front with drip tray for wet films. Finished in grey-green hammered lacquer.

X-ray Film Corner Cutter

Removes the square corners from X-ray films. The lever cuts to a radius of 1 in. and the base provides a receptacle for the off-cuts. Finished in cream stoved enamel and chromium plate.

Senior and Junior X-ray Film Drying Cabinets

Two drying cabinets, 4 ft and 2 ft $6\frac{1}{2}$ in. wide, with accommodation for 66 and 40 films respectively. Adequate drying facilities are provided to give speed consistent with freedom from drying marks.

THE BRITISH JOURNAL
PHOTOGRAPHIC ALMANAC

AND

Photographer's Daily Companion

WITH WHICH IS INCORPORATED

THE YEAR BOOK OF PHOTOGRAPHY AND AMATEURS' GUIDE AND THE PHOTOGRAPHIC ANNUAL

1954

EDITED BY

ARTHUR J. DALLADAY, A.Inst.P., F.R.P.S.

HENRY GREENWOOD & CO. LTD., PUBLISHERS
24 WELLINGTON STREET, LONDON, ENGLAND

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The present Almanac first appeared in the form of a wall calendar for the year 1860, and was issued as a supplement to the " British Journal of Photography " of Dec. 15, 1859.

The Almanacs for the years 1861-65 were $4 \times 2\frac{1}{2}$ inches in size, and were issued gratuitously to subscribers to the " British Journal of Photography ".

The present crown 8vo format was adopted for the 1866 issue, which was the first to be sold exclusively as a separate publication.

Successive editors of the Almanac:—

1861-2	SAMUEL HIGHLEY.
1863	JAMES MARTIN.
1864	EMERSON J. REYNOLDS.
1865-79	J. TRAILL TAYLOR.
1880-86	W. B. BOLTON.
1887-96	J. TRAILL TAYLOR.
1897-1905	THOMAS BEDDING.
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1935	H. W. BENNETT. P. C. SMETHURST.
1936	HENRY W. BENNETT. ARTHUR J. DALLADAY.
1937-	ARTHUR J. DALLADAY.

MADE AND PRINTED IN ENGLAND

CONTENTS

Complete Alphabetical Index to Text, p. 606

Indexes.

THE SEVEN AGES OF PHOTOGRAPHY

BY THE EDITORS

To every student of the history of photography there come, inevitably, moments of despair as some realization of the tremendous size and scope of the subject becomes apparent. Yet every thoughtful photographer will admit that the history of the subject is not only of the greatest interest, but also of vital importance to the practitioner of the art; for it is essential that the history of photographic development should clothe the bare bones of fact and data so that the ordered progress of theory and practice may stand forth and be understood. The history of photography as all other real histories, follows a path which can show how our practice of today has evolved in time. As the path is followed one meets with many discarded ideas and theories. There is much useful experience to be had in the consideration of these earlier attempts, and the realization of why they failed or were discarded can teach many valuable lessons. Waste of time, energy, and materials can be prevented if we are aware of the work of our predecessors; for there is not, usually, any purpose served by re-treading paths that have already been investigated.

It has therefore appeared to us that if we could take a series of view points along the road that photography has travelled we might be doing some service to our readers by presenting to them some account of what might be regarded as landmarks in photographic history, and of some of the pioneers who laid the foundations upon which their successors, the photographers of today, have built. To this end we have, perhaps arbitrarily, divided our subject into ages or periods, because it seemed possible to group certain epochs under seven headings and so separate them from one another in time and in character. We have therefore conceived of the story of photography as comprising seven ages which, in chronological order, are: first the age of discovery; next the age of the portrait lens, and with it the development of portraiture as the major achievement of photography at that time. Next we have the age of the photographic plate, both wet and dry. The fourth age might be dubbed the age of accurate exposure, in which men began to measure light intensities, and also to measure the sensitivity of their materials to light of many wavelengths. The fifth age is that of sensitivity to a much broader range of the spectrum than theretofore. This was the age that saw the development of the orthochromatic and later of the panchromatic plate, with even further extensions into the ultra-violet and the infra-red. With sensitization there came at a somewhat later period desensitization before and during development. The sixth age saw notably the application of photography to science and included the production of the high-speed camera as well as the perfecting of very intense short period illumination; it saw also the development of the stroboscope, the cinematograph, and all those other instruments and mechanisms that employ photography in the service of science. The seventh age is that of photography in full colour and is only now developing. This short summary will emphasize our use of the word arbitrary in describing the adoption of our seven ages, and it may be said at once that they merge one into another without finite boundaries. That is, indeed, the manner in which all the sciences have developed, but our own subject of photography is perhaps remarkable in that discovery came about almost suddenly and, if one may use the word, in concentrated fashion.

The Age of Discovery

The fact that certain materials were susceptible to change by the action of light had long been known but had, until the early experiments of Wedgwood and Davy, and later Talbot, Daguerre, and Niepce, much more interest for photochemistry than for true photography. What was remarkable was that three such diverse but truly photographic processes as were embodied in Niepce's asphaltum process, Daguerre's daguerreotype, and Fox Talbot's talbotype or calotype should have appeared all in the space of half a dozen years, whereas in all the long period before their discovery the nearest approach to photographs had been those resulting from the experiments of Wedgwood and Davy. There is much justification for speaking of the early days of photography as the age of discovery, for active investigations were proceeding in many other directions.

There was the work of Sir John Herschel, which he published in 1819, on the power of the thiosulphates to dissolve silver salts, later to become the first practical method of fixing the developed silver image. Note the year 1819—the centre point, one could say, for very numerous discoveries of the highest importance to photography. Within a very few years of Sir John Herschel's discovery there were also recorded the work of Gay Lussac and Thenard in France in photochemistry, and the work of Seebeck on the possibility of photography in natural colours which he communicated to Goethe; the discovery of iodine in 1814 by Bernhard Courtois and of bromine by Balard in 1826, and Grotthuss' publication of laws of photochemical adsorption in the year 1817.

There was also the discovery by Liebig of the method of removing stains made by silver nitrate which solved a problem akin to that of fixation as did Herschel's thiosulphate. Liebig treated the stains with chlorine water by which the reduced silver was converted into white silver chloride; he then applied concentrated ammonia which completely dissolved the silver chloride. This is perhaps better described as photographic reduction than as fixing. Do not let us forget also Joseph Nicéphore Niepce, the father of Claude and of Nicéphore Niepce. Joseph may well be named a principal inventor of photography with the camera, and especially of heliogravure, because of his process of etching asphalt-covered metal plates. It was Joseph Nicéphore Niepce who contributed much of the actual photographic part of the procedure when he joined Daguerre. It was on 14th December, 1829, that a contract was drawn up by a notary between Nicéphore Niepce and Daguerre. A literal translation into English of the original agreement is given in the English translation of Fder's History of Photography (translated by Edward Epstean and published in New York in 1945). As early as 1816 he had constructed a miniature camera, in fact in the spring of that year he had constructed three small cameras which he used in experiments, not only in photography, but also in optics where he used a diaphragm to control and in part to correct the lack of sharpness in his images, due to using simple condensing lenses as objectives.

Once the agreement between Daguerre and Niepce was in force both the partners worked hard at the improvement of their processes. Daguerre discovered the light-sensitivity of iodide of silver, and an important result of this was the use of iodized silver plates as a light-sensitive material. The later discovery, by accident and not by design, that mercury vapour could develop what is virtually a latent image in the iodized silver plates produced a result that transcended anything previously attained. Then came the account of the discoveries reported to the Academy of Sciences by François Jean Arago, a noted French scientist, on 7th January, 1839, which led to the purchase of the process of Daguerreotypy by the French Government and its donation to the world at large. Thus one phase of the age of discovery ended in the publication of the method of producing daguerreotypes.

That method had a fundamental disadvantage. It produced only a single image in the camera and there was no method of multiplying that single image by any simple process. The first practical duplicating process of this kind, which provided a negative image on paper from which positive prints could be obtained by a simple contact printing process, was that invented by William Henry Fox Talbot of Lacock Abbey in Wiltshire. The origin of Fox Talbot's investigations was his desire to obtain permanent records of the images he obtained in the camera obscura he had used on a trip to Italy in 1823. The tracing in pencil of the light pictures of the camera obscura did not satisfy him, nor was he more satisfied with the results obtained with a Wollaston camera lucida in the course of a later Italian visit in 1833. As Henry Fox Talbot had studied chemistry he was aware of the earlier work of Schulze, Scheele, and Wedgwood with light-sensitive salts of silver. He returned to England in January 1834 from his latest Italian trip and at once commenced experiments first with paper coated with nitrate of silver and later with chloride of silver. These experiments were described by Fox Talbot himself in the preface to his book "The Pencil of Nature" (London, 1844). The illustrations for this book were prepared by Talbot himself using his calotype process of printing from paper negatives on silver chloride paper. In the same book he relates that he became acquainted with the experiments of Wedgwood and Davy which date in the first instance from 1802, although it was in 1837 that Talbot learned of them.

There is therefore a direct connection leading from Schulze to Scheele, from Wedgwood and Davy direct to

Talbot who, in 1834, saw a report by Sir Humphrey Davy on the greater sensitivity to light of silver iodide as compared with silver chloride. Talbot's experiments did not agree with this finding so far as visual results were concerned. He discovered that an excess of potassium iodide reduced the light sensitivity of the silver salt. These varied experiments of Fox Talbot were only a side-issue at this time for he was particularly interested in various physical and mathematical investigations into optical phenomena in certain crystals and the interference of light.

When the preliminary account of Daguerre's invention was published in January of 1839 no details of his actual process were included, and Talbot, without any knowledge of what Daguerre's process was, made public his work in the photographic field and wrote a letter to the Royal Society in London on 30th January, 1839, in which he described the process of making light images on silver chloride paper and their fixation with a strong solution of common salt. In the following month (February, 1839) Talbot wrote to Biot, a physicist member of the French Academy, telling him of the methods of fixation of the photographic image that he used in addition to that of sodium chloride, either a solution of iodide of potassium, or the thiosulphate of soda that had been given to him by Herschel and which Talbot asked should be kept secret for the present. In the following month the secret was revealed in a further letter Talbot wrote to Biot (15th March, 1839) in which he states that he has discovered the greater light-sensitivity of silver bromide paper. Thereafter followed a positive spate of discoveries such as the light-sensitivity of bichromated glue, heliographic steel etching, copper etching on light sensitive bichromated glue coatings, but above all his obtaining of a latent image on paper and its development with gallic acid. These discoveries were made in September, 1840, and Talbot himself gave a most interesting account of them and of their effect upon his work in an appendix to the 2nd Edition of Tissandier's " A History and Handbook of Photography ", published in London in 1878. Appendix A.

Remarkable as were the discoveries of Daguerre, Niepce, and Talbot, they were not alone our justification for calling this wonderful period the age of discovery. There was the work of the Reverend J. B. Reade, who, in 1839, discovered the accelerating action of tannin on the blackening of silver-coated or impregnated paper. Later a Frenchman, Blanquart-Evrard, further investigated Talbot's process and improved it by showing that silver iodo-bromide, plus free silver nitrate and without gallic acid, provided a much more light-sensitive coating for the negative process and so gave shorter exposures and clearer images when the application of the gallic acid was not made until after the exposure, that is as a developer. Blanquart made a commercial success of the modified Talbot process and printed large editions from photographic paper negatives in Lille in 1851, as well as others in Paris.

An interesting variant, in the form of printing paper which produced positive images direct in the camera, was the invention of Hyppolite Bayard, who made public his process a month before Daguerre published his methods in 1839. The process was an ingenious one consisting in exposing silver chloride paper which had been blackened by light and immersed in a 4% solution of potassium iodide solution, and while still moist exposed in the camera. Those portions acted upon by light would then be bleached by the release of iodine from the potassium iodide and its combination with the blackened silver image, so that a direct positive image resulted in the camera.

This method was apparently described by various workers among whom were Fyfe at Edinburgh in April, 1839, Herschel in London in 1840, and Robert Sterry Hunt, the notable photo-chemist, as well as a number of workers on the continent. It is particularly interesting to note that the photo-chemical reaction we know of as the Herschel effect, and about which so much is written in these days in photo-chemical literature, was described in the Philosophical Transactions for 1840. Sir John Herschel said that he made the first important observations on 27th August, 1839, when he saw that silver chloride paper turned dark in the concentrated light of the solar spectrum, but bleached under the oxidizing action of red light. In 1842 Draper, in 1846 Lerebours, and in 1847 Claudet, showed that this effect also applied to the latent image on iodized silver daguerreotype plates and to the development with mercury vapour. This was the genesis of the effect and its investigation that for over a hundred years has provided so much light on the theory of the latent image, played so useful part in the application of infra-red photography, aided in the production of direct positives and duplicate negatives, and still manages to see to the production of half-a-dozen or more pieces of useful original research a year. Perhaps by now we have justified our title for our first age, namely The Age of Discovery. Those familiar with the early story of photography will know that we have been able only to touch the high lights of that period of intensive investigation which in the course of only four or five years saw the publication of so much pioneer work and the disclosing of such important processes. As was to be expected all the various procedures fell far short of what was required and what eventually evolved from these primitive beginnings, and we may therefore take a step forward and consider our second age: that of the portrait lens and of the development of portrait photography. This period and its achievement arose out of the drawbacks and shortcomings of the materials produced during the age of discovery.

The Age of the Portrait Lens and of Portrait Photography

Everyone who experimented with the earliest daguerreotype knew that long exposures, due to poor light sensitivity, were the main drawback to the rapid growth of daguerreotypy. Hence there was a time when portraits were not mentioned in connection with the daguerreotype, nor did Daguerre venture on portraits among the many examples of his process that he sent to various crowned heads in Europe. It is possible that Professor J. W. Draper in New York produced the first portrait on a daguerreotype, but he had to give an exposure of the order of half an hour in full sunlight. An outstanding contribution to shorter exposures with daguerreotypes came from J. F. Goddard of London who discovered that a very notable increase in light sensitivity was obtained by using the vapour of elemental bromine in combination with the iodine vapour used in sensitizing the silver plate. This he disclosed in a letter addressed to a London paper, the *Literary Gazette*, and the letter was dated 12th December, 1840. A Viennese shared with Goddard the credit, for he also made the same discovery.

A most important contribution to decreasing the time of exposure was by the increase in the light transmission of the camera lens that resulted from the work of Professor

Petzval of Vienna, who invented the portrait lens. Before his invention a slow single Chevalier lens was the only one available and this was so slow that the photographer who used it was limited to taking pictures of inanimate objects because of the very long exposures involved. Not only were the single lenses slow but they also had the defect of not giving sharp images at full aperture.

Petzval, after an intensive investigation and a comprehensive mathematical study of the problem, produced two large aperture lenses. First was the celebrated portrait lens and next a rapid lens for landscapes, later called orthoscope. The portrait lens had an aperture some sixteen times as large as the Chevalier single lenses, while the orthoscope had a smaller aperture but a larger and sharper area of definition, and was consequently of greater value for landscapes and architectural subjects. It was more rapid than the Chevalier lens and was also a doublet. Both types were produced by the Voigtländer optical establishment in Vienna. The glasses used for the first portrait lens were hard crown and light flint and the relative aperture of the lens was f/3.6. It was the lens that made portrait photography practical, and using iodo-bromide or iodo-bromochloride plates a portrait could be produced with an exposure of fifteen to thirty seconds in a favourable light. The commercial success of the Voigtländer firm with the Petzval lens was phenomenal. The quarrels that arose over priority beween Chevalier and Voigtländer are part of the history of photography, and space does not permit us to discuss them here; the same can be said of the dispute between Petzval and Voigtländer which resulted in a break between them in 1845. What is vastly more interesting is the story of the amazing rise in popularity of the daguerreotype portrait, the increasing interest in and development of photography, and the onset of a veritable age of portraiture. There is no question that the discovery of photography and its publication to the world came just when the world was ready for it.

The amazing growth and popularity was no accident, nor was it confined to any one country or even continent. Even before the faster lenses of Petzval, travelling daguerreotypists were to be found in most countries in Europe, in the United States of America, in Malta and Smyrna and in Mexico.

The first daguerreotype studio in England was probably that of Beard and Claudet opened in London in 1840. In the United States there was Professor John W. Draper, already mentioned, and also another remarkable man, Samuel F. B. Morse, the inventor of the Morse telegraph and of the Morse alphabet. Morse visited Paris in 1838 and had met Daguerre whose Diorama studio he visited and was shown the invention of daguerreotypy, at that time secret. Morse maintained contact with Daguerre, and as soon as the process became known in America, about August or September, 1839, Morse had the necessary apparatus constructed and experimented with the process. He also associated himself with Professor Draper, who had already had a success with daguerreotypes. Not only their efforts, but those of many others were crowned with success and the process was experimented with and converted to business enterprise with the most remarkable rapidity. Yet there was always that fundamental disadvantage that it produced only a single photographic image and was incapable of multiplication by simple photographic methods. It was this condition that caused the decline and almost sudden disappearance of the daguerreotype soon after the death of its discoverer in July, 1851.

It was Fox Talbot's calotype which aided in the growth and spread of photography and provided a means whereby it was possible to supply any required number of copies of a particular picture or portrait. The procedure was to sensitize paper by coating with silver nitrate, followed later by potassium iodide, expose in the camera and then develop the latent image with what was called gallo-nitrate of silver, fix in hypo, wash and dry. The negative so produced was often waxed, which helped in the printing and reduced the time required to obtain a print. The process was cheap and simple. It is interesting to note that many of the earliest practitioners of calotype were artists, as witness David Octavius Hill, John Leighton, Fox Talbot himself, P. H. Delamotte, and many others; and the artistic conception and the obvious application of composition in the work of most of these artist photographers not only explains the rapid rise to popularity of the early photographers but also provided some, at least, of the stimulus to improve both materials and processes which in only a few years saw the development of the photographic plate, both wet and dry.

The production of images, and in particular negatives on glass, was the invention of another member of the Niepce family, namely Claude Niepce de Saint-Victor, a cousin of Nicéphore Niepce, who had carried out experiments with dyes and reported some of his discoveries and their application to the French military authorities; this led to his being supplied with a small chemical laboratory, and 1847 saw his invention of photographing on glass plates using albumen as a vehicle mixed with certain other organic substances which increased the sensitivity of his material. Silver iodide and free silver nitrate were present and development of the plate after exposure was first with gallic acid but later with pyrogallic acid. His " glass pictures " were called Niepceotypes and provided grainless transparent negatives.

Henry Fox Talbot experimented with albumen plates and produced very fast material by albumenizing a glass plate, silvering and then supercoating with a second albumen solution to which ferrous iodide was added, and then repeating the silver bath. This process he patented in June 1851. Plates so produced were so sensitive that Fox Talbot was able to obtain a sharp photograph of printed matter pasted on a rapidly rotating disk using an instantaneous exposure by the light of an electric spark. Many variants of the albumen process were used and out of them there were developed stereoscopic glass positives and also lantern slides. These latter first appeared, with projection apparatus, about 1846.

One interesting application of the albumen process was its use by Lippmann in his early experiments in photography in natural colours by the interference method. The introduction of the wet collodion process by Frederick Scott Archer in March 1851 supplanted all the older processes by reason of its high light-sensitivity and its comparative ease of manipulation and above all its freedom from patent restriction. Added to all this there was fine detail and the availability of large sizes if required.

The collodion negative process in the course of ten years spread over all Europe and most of America. During the early years in which the wet collodion process was used there was much controversy as to who was the actual discoverer of the process. Among the claimants were English, French, and other nationals, but the credit for presenting the process in a logical and intelligent manner and for giving practical demonstrations of its use belongs to Frederick Scott Archer, who also invented the stripping film by coating the negatives with rubber solution, a process which found many and varied application in process work. It was rather remarkable that so long a period had to elapse before the silver bromide gelatine dry plate was made a practical negative material for the photographer. That was not until September 1871. There had been plenty of experiments in the interim but few if any successes until Dr. Richard L. Maddox, a diligent amateur photographer as well as a medical practitioner, produced the first successful photographs made on gelatine silver bromide dry plates and handed them to the then Editor of *The British Journal of Photography*, J. Traill Taylor, together with an article explaining his process, and emphasizing the way in which his process differed from the various methods that had preceded it. Dr. Maddox himself recognized how far from final the process was, he was a modest man and wrote, " as far as may be judged at present, the process seems worthy of further and carefully carried out experiments; if found advantageous, progress in photography will be promoted by it." It certainly was, for from the Maddox process have stemmed all the subsequent developments in emulsion making that mean so much to us today. Once again, however, there was a big time lag before very notable advances were made once it had been realized that bromide should be in slight excess and that emulsions should be washed free of soluble salts if they were to have good keeping properties and increased sensitivity. Collodion instead of being the vehicle became in due course the base or support, and, later—to speak only of flexible materials—celluloid became universal until it was replaced by non-inflammable plastics which now carry the emulsions for flat film, roll film, X-ray films and many other varieties of sensitive photographic material.

The Age of Sensitometry

Writing about the work of Hurter and Driffield in the introduction to their own manual of sensitometry, two eminent French photochemists said " that which Lavosier achieved by introducing the balance into chemistry was was done by Hurter and Driffield for photography. They allowed it to take rank among the exact sciences." As far back as 1839 Arago saw in the light sensitive surface of the daguerreotype a medium with which to measure the intensity of light. Earlier than that Count Landriani of Vienna used silver chloride paper in a recording photometer driven by a clock movement. He produced what was a very simple form of sunshine recorder which provided a record showing by unequal darkening of silver chloride paper the intensity of light at different hours of the day. Based on the same principle exposure meters were invented by quite a large number of people but it was not until 1861 that Bunsen and Roscoe brought some order and standardization into this field by introducing a standard grey. They also observed that the time necessary for producing a definite blackening of silver chloride varies inversely as the light intensity, and to obtain the same blackening it is necessary that the product of the intensity and the time of the exposure (It) should be constant. This relation, known as the Bunsen Roscoe Law, is the basis of all measurements by photographic actinometers. Actinometers were used by Draper and by Bunsen and Roscoe and in both cases the instruments made use of the combination of hydrogen with chlorine which is accelerated by blue and violet rays. But instruments based on this reaction were not simple to devise or to control and so it came about that the first practically useful sensitometer was that of Leon Warnerke, invented in 1880 and later placed on the English market. It consisted of a gelatine grey intensity scale marked off in graduated spaces, and the light source was a blue phosphorescent plate which was illuminated or activated as required by burning magnesium ribbon in front of it. Ten degrees on Warnerke's sensitometer was at that time about the sensitivity of a wet collodion plate while the ideal for the 80's for silver bromide gelatine emulsion was 25 Warnerke, that was approximately 60 times greater sensitivity than a wet collodion plate. In 1901 Chapman Jones, chemist and photographer, introduced an instrument somewhat similar to the Warnerke sensitometer and called it the " Chapman Jones Plate Tester ", indicating that it was intended for testing photographic plates. It comprised a set of progressively graduated squares of neutral grey numbered 1-25 and also a set of gelatine colour filters, and for years this provided the only approach to accurate and comparative testing used by many photographic manufacturers. The Scheiner sensitometer of 1894 was a somewhat more exact instrument of the same kind and was intended for use with the Hefner Standard amyl acetate lamp as light source. It was widely used on the Continent not only by plate and film makers but for all classes of both negative and positive sensitive materials. In 1919 there appeared the Eder-Hecht wedge sensitometer which carried spectroscopically standardized colour filters in red, yellow, green and blue, and a scale in candle-meter seconds obtained by using a free-burning light source of 2 milligrams of magnesium ribbon, standardized as a white light source. However, nearly 30 years earlier Hurter and Driffield had published their sensitometric methods whereby curves were plotted having as co-ordinates the logarithm of the light intensity and the density of the plate. Many other outstanding names could be quoted, particularly Sir William Abney in England and K. Schwarzschild and E. Kron in Germany, who made outstanding contributions to our knowledge of sensitometry and to the action of light on light-sensitive emulsions. All this period, which we have called the age of sensitometry, we could equally have described as the age of more accurate exposure, in which the effect of light on the photographic emulsion was closely studied and measured and the foundations were laid for the application of photographic methods in many branches of science as well as in industry.

Perhaps the greatest service of sensitometry was the guidance it gave to the photographic manufacturer in his preparation of emulsions. Thanks to the various instruments in the form of sensitometers he was able to follow the process of sensitizing his emulsions and to find how to control factors such as speed, range of contrast, fineness of grain, and other qualities, and it was due to the wider use of sensitometry that such progress was made in producing various types of emulsion and also following the sensitizing of emulsions to the ultra-violet at one end and the far infra-red at the other end of the spectrum.

The Age of Colour Sensitizing

That light-sensitive silver salts showed differences of reaction to light of different colours may have been known to Aristotle some 350-321 B.C., but it was not until the 18th century that any real study of the subject is recorded and we then have the work of Schulze, of Priestley, of Scheele, and others and, at the turn of the century the work of W. Herschel and others, notably Sir John Herschel. The first really significant discovery was made by Professor H. W. Vogel in 1873 when he discovered what are called the optical sensitizers. Very shortly, the discovery was made when Vogel noted that some collodion dry plates made in England by Stuart Wortley, and having an anti-halation preservative added, possessed notably increased sensitivity to the green of the spectrum. He found that the cause of this increased sensitivity was a yellowish-red dye known as corallin and that this dye absorbed yellow and green and sensitized for yellow and green a silver bromide collodion dyed with it; he also found that certain green aniline dyes sensitized silver bromide collodion into the red. Thus Vogel discovered the " optical sensitizers " as he called them.

The discovery was published in 1873. Owing to various accidents doubt was thrown on the validity of Vogel's claims, and for some years there was great activity in many photographic laboratories which added materially to our knowledge of sensitizing dyes, fully vindicated Vogel's claims, and provided both the orthochromatic and the panchromatic emulsions which later made colour photography possible.

The story of the earlier years of sensitizing and its utilization is truly a tangled skein for there were many workers in the field and there was much confusion. An example of this is that Vogel's discovery was first used in actual practice in France and not in Germany, for it was Ducos du Hauron and Cros who anticipated the manufacture of light sensitive plates for three-colour photography, and in fact had applied for a patent covering a three-colour process as early as 1868. Unfortunately plates sensitive to green, yellow, and red were not available until Vogel discovered his " optical sensitizers ", which Ducos du Hauron quickly made use of. Later eosin silver was used, particularly by E. Albert of Munich for sensitizing collodion emulsions. It had been noted by several workers that eosin worked well as a sensitizer with collodion, but in 1882 a Frenchman named Attout, trading as Tailfer and Clayton, took out a French patent for gelatine silver bromide plates sensitized satisfactorily with the sodium tetra-brom-fluorescein and offered dry plates colour sensitized in this way. The English rights of this patent for what were called the orthochromatic process were acquired by B. J. Edwards and Company in 1886 and thenceforward were made and supplied by B. J. Edwards until the outbreak of the first world war.

Meanwhile Vogel had shown that cyanine was a good sensitizer for the red end of the spectrum and Schumann had produced gelatine plates sensitive to red. Vogel found that quinoline red was an excellent sensitizer and when mixed with basic quinoline blue, or cyanine, provided a harmonious sensitizing for green, yellow and orange. This provided the first panchromatic plate. Vogel called this his Azaline plate and kept his formula secret. An important step forward was the discovery by Eder of the advantages as a sensitizing dye possessed by erythrosin, which is the salt of tetra-iodo-fluorescein, over eosin, the corresponding bromo-salt. Professor Eder gave his results freely to the scientific world, and photographic manufacturers, in particular, soon took advantage of the new sensitizer and especially of the notably increased colour sensitivity brought about by the addition of ammonia. Pages could be filled with details of the many further discoveries that built up the way leading to modern colour sensitizers. The fuller story can be read in Eder's *History of Photography* and Wall's *History of Three-colour Photography* published in 1925.

It has to be admitted that from 1900 until the outbreak of the first world war the contributions of British photochemists were hardly spectacular. The bulk of materials used came from abroad, Germany being the chief producer.

It is perhaps natural that having spoken of sensitizing we should also mention its opposite desensitizing. Here the story is much simpler and begins with the observation of Dr. Lüppo-Cramer that certain developers and some other substances greatly reduce the sensitivity of unexposed silver bromide but still allow a latent image to be developed. The French photochemists Lumière and Seyewetz also investigated the phenomenon. It was Dr. Luppo-Cramer's discovery of dyes that could act as desensitizers that proved of great practical importance and led to the use of safranine dyes which permitted the development of highly sensitive plates and film in a clear yellow light. All that was necessary was the addition of a solution of safranine dye to the developer. Later on came the production of pina-dyes which were free from the disadvantage of safranine that it left a stain that was difficult to wash out. The result of the newer work was the production of pinakryptol green. In the studies of desensitization since the appearance of safranine the names of König, Schuloff, and Homolka are of outstanding importance for their achievements. Parallel with work undertaken to find desensitizers there was activity in investigating materials that could prevent the growth of fog in emulsions and act as preservatives.

In a minor sense the production of such chemicals developed notably after the close of the second world war, and their advent has been of great advantage to photographic manufacturers because in the great majority of cases they are of real assistance in controlling the properties of emulsions, and that, with the extremely sensitive emulsions of today, is vastly important.

The Sixth Age, that of the broadest possible applications of photography is with us today. It has been rendered possible by the progress and experience of the periods we have already traversed. The success of modern photography is the measure of assiduous investigation in everything pertaining to the subject that we have attempted to sketch in the preceding account. Although many of the steps may have been disconnected and some of the discoveries lacking in useful applicability they provide a continuous, if slow, chain of progress that little by little has answered all the queries and filled in most of the blank spots that were so evident in the older materials and processes. As the review proceeds the real importance of certain steps becomes manifest. The importance of fixation is an example, without it most of the record work which plays so big a part in our work today would be worthless and indeed would never have been undertaken. Our studies in how to influence the sensitivity of photographic materials has had results not only in allowing extremely short exposures to be given, but also in showing how to use our material to solve all sorts of difficult problems in many sciences. It needs only to mention spectroscopic analysis, X-ray crystal analysis, the detection and examination of atomic particle tracks and the behaviour of many of the comparatively newly discovered atomic particles, to remind us of the entirely new realms that modern photographic emulsions have opened up to us. We can think too of the many problems that modern photography is helping us to solve in relief of libraries and record offices, of the immense help that aero-photography is in modern prospecting and in ground survey and mapping. There is the analysis of rapid movement, the investigation of the behaviour of metals and alloys under stress and at high temperature or both. There are entirely new worlds about us and their properties and conditions can be investigated, in many cases, by photographic techniques.

The Age of Photography in Colour

What are we to say of the seventh age—the age of photography in full colour? This age differs profoundly from all the ages preceding it. To begin with, it follows a period wherein black-and-white photography had reached a state of near perfection, while colour photography itself is still suffering its birth pangs. It comes at a time when the great mass of the public is photographic minded and, if not yet trained to nice discrimination, knows enough to have a powerful influence on the commercial aspects of colour photography; at a time too when most serious photographers can turn out presentable black-and-white photographs and have no hesitation in tackling the new art, beset with difficulties though it be, whilst possessing in but few cases any real knowledge of the underlying causes of their successes, equally with their failures.

Manufacturers of colour materials are forced by clamant public demand to run before they can, with any degree of surety, walk; and problems are set for them which, to give them credit, they have gone a very long way towards solving. The Patent Office is swamped with a veritable jungle of applications dealing with every aspect, many of them, to the uninitiated, appearing to comprise complex chemical problems not remotely connected with photography. And behind all this welter progress is steadily being made, so that it is far from unusual for a person well versed in the theory and practice of colour photography to be confronted, as a *fait accompli*, with results which he would, on fundamental grounds, have considered technically impossible.

Paradoxically, this newest phase of photography goes back to days before the discovery of photography itself: man was experimenting with colour long before photography was even thought of, and the mere possibility of colour photography as we know it today rests on certain well defined discoveries and inventions which in themselves had no relation, at the time to colour photography: such fundamental advances as the production of the panchromatic emulsion and Fischer's basic discovery of colour development.

But whereas the history of photography has in the past been largely one of steady, unspectacular development, much of it—including the earlier story of colour photography—the result of individual effort, the present age is one of mass invention—thousands of brains all contributing masses of jigsaw data from which the key scientists select the pieces and build up the final picture. Many pieces are still missing. Some of the pictures are barely taking shape. Some are not even started, for the basic pieces are not even cut.

" Why Colour Photography Cannot Reproduce Colours " is the title of a current lecture familiar to club members. Only a purist, prepared to support it with expert knowledge of chapter and verse, would today dare to use this challenging phrase. But in fifty years time, or twenty, or may be far sooner—who knows?—we confidently anticipate that it will no longer be true even in the purist sense, and when that day comes photography will have achieved its most exalted plane: not only will it then be possible for any one of us to preserve an enduring remembrance, in every delicate tint, of fleeting beauty, but our surgeons, our scientists, our industrial technicians, will be able to record for accurate control the conditions which may be vital to their later work. Such colour records cannot, in the present stage of development of colour photography, be permanently preserved with the high degree of accuracy without which in many cases they are useless.

Already photography is inextricably bound up with every detail of our daily life, but for the most part its work is done silently, in the background, unhonoured and unsung. In the days of its millenium it is safe to predict that Cinderella will no longer, clothed in rags, be doing her chores in her basement kitchen while her more fortunate, and by no means more attractive sisters bask in the sunshine of popularity and favour.

EVALUATING COLOUR QUALITY ON TRIPACK MATERIALS

By George Ashton, A.R.P.S.

Most photographers will confirm that the layman is by no means a good judge of black-and-white print quality. Non-photographers will often accept a poor print simply because they do not know how much better it could be. But in colour photography things are different; much to the consternation of the technicians, people seem to think that they know instantly if a colour print departs appreciably from truthful rendition of a scene. Perhaps because the colour picture is somewhat closer to real life than a black-and-white picture, comparison with real life becomes easier and indeed inevitable. But, whatever the reason the fact remains that even the completely non-technical person can be most critical of a colour picture, although not always can he say in what respect it is not up to standard.

But the knowledgeable colour photographer must be able to see in what way a colour picture falls short of the best possible in colour quality. Defects can arise at a number of stages, and the proper analysis of such defects is of the greatest importance. Poor colour quality can be due to faults at the exposure stage or in the lighting, in the processing or—least likely of all—in the material itself. In order to be able to correct such defects—to know how the shot should be retaken, to know what processing changes may be attempted, or to be able to forecast the possibility of correction at a later stage, such as half-tone blockmaking—needs some knowledge of simple colour sensitometry. Unfortunately, such experience is not readily gained by the average photographer who is concerned solely with practical results. However, an extension of simple black-and-white sensitometry to colour materials can provide much useful information to the practical photographer, and such an extension can make the interpretation of off-balance results a good deal less difficult.

Assessing Balance

Any of the tripack processes available today are able to give acceptably balanced colour pictures. Poor colour balance is not a fault inherent in a process, although any particular process may have dye characteristics and tone rendering which tend to give a characteristic type of colour rendering. Only experience with a particular material will reveal its capabilities to the photographer.

The grey scale has for many years been the accepted standard for assessing colour balance; if we photograph a scale of neutral tones, ranging from white through grey to black, it ought to reproduce as neutral in the colour picture. Any variations in colour balance will then show as a colour cast in what should be a neutral image.

The grey scale is without doubt a useful aid, for if the process can reproduce the scale as neutral throughout its tone range (and it is assumed that a grey scale of approximately the same range as a normal subject is being discussed) the process is in good balance and will in all probability give acceptable reproduction on practically any subject.

But for the sake of accuracy it must be admitted that as yellow, cyan, and magenta dyes of higher saturation become available, a perfectly balanced grey scale does not necessarily give the best possible balance on, say, flesh tones, which most people consider more important than grey scales! The reason for this is not difficult to understand. A grey in a tripack colour material is made up of a certain quantity of each of the three component dyes, and it can be shown, either by spectrophotometric analysis or by simple wavelength by wavelength addition of the three dye absorptions, that the visual grey does not in fact absorb equally throughout the spectrum. There are noticeable absorption peaks in the red, green, and blue regions of the spectrum.

A little thought will show that the more saturated and brilliant the dye colours the more pronounced will these peaks in the absorption curve for a neutral grey become. From this it follows that a colour process using very saturated dyes will be more difficult to hold in proper colour balance than a process using less saturated dyes. It is for this reason that a given degree of out-of-balance is almost always more noticeable on an imbibition print (which uses relatively brilliant dyes) than it is in a multi-layer print which depends on the rather less saturated dyes given by colour development.

But in spite of the fact that a well reproduced grey scale is not always a perfect indication of good colour balance, it is nevertheless a very good guide especially when the photographer appreciates what sort of a grey corresponds to correct balance in his chosen process.

The Extension of Grey Scale Assessment

Many photographers have a working knowledge of simple black-and-white sensitometry and the drawing and interpretation of characteristic curves. Even a very elementary knowledge of this branch of photography can easily be extended to colour materials by further consideration of the grey scale. Let us suppose that such a scale has been photographed or printed on to a reversal colour film and has reproduced a good visual grey. The densities of the steps on this scale could be read and plotted in the usual way against the original grey scale reflection densities or transparency wedge densities. The result of such a plot would appear as in Fig. 1, where three things are apparent. First the very long toe, sweeping up to a relatively high toe break. Second, the fairly steep slope of the straight line portion of the curve; and third, the relatively high maximum density. All of these characteristics are typical of colour reversal materials.

From such a characteristic curve plotted from a neutral scale on colour film it is perhaps, not too difficult to visualise characteristic curves plotted for each of the three individual layers in a tripack colour material. However,

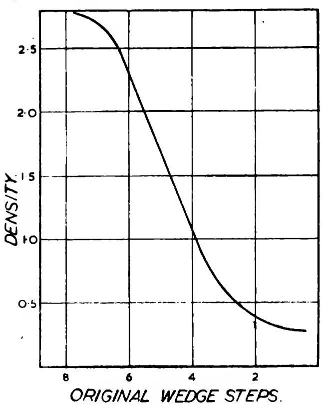


Fig. 1.

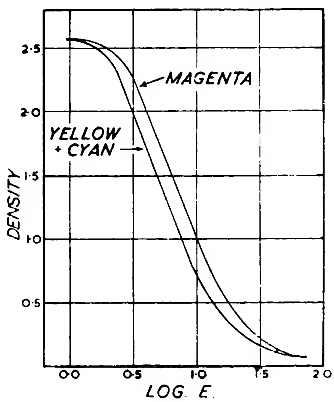


Fig. 2.

in practice, such a set of characteristic curves for the yellow, cyan, and magenta dye images are by no means easy to plot, principally because of difficulties in measuring colour densities.

But for our present purpose these difficulties need not concern us; it is enough to realise that three such characteristics *can* be plotted and even the visualisation of three such curves can be most helpful in analysing some of the faults seen in colour photographs.

The More Common Faults

The simplest of these faults is lack of density balance; the three emulsions have the same contrast but the three emulsion speeds are not well matched. For example, Fig. 2 shows the case of a reversal tripack which shows an excess of magenta, that is the green sensitive layer was slightly under-exposed. As a practical example of the usefulness of such a set of curves, the correct green filter density to bring the three curves back to equality could easily be found by measuring the log. E shift between the magenta curve and the other two. In practice, of course, a suitable light green filter could easily be found by trial exposures on a small quantity of this batch of film and then used as a standard filter for the remainder of the batch.

At first sight it might appear that a processed transparency showing this type of defect could be corrected by binding it up with the appropriate density green filter. But a few moments consideration of the characteristic curves will show what the exact effect of this expedient would be. The magenta densities are too high by about 0·03 of density over the straight line portion of the curve. A green filter of density 0·03 placed over the transparency would certainly lift the yellow and cyan curves by that amount and thus would correct the straight line portion of the characteristic. But over the long, sweeping toe of the characteristic there would be too high a green density and the highlights of the picture would then appear green. This effect can be seen from Fig. 3. Conversely when the filter is of the correct density to bring some of the densities on the toe into correct balance, say, in flesh tones, it will still be too dense for the extreme highlights, which will still appear green; and it will not be enough to correct the straight line portion of the curve and so the mid-tones will still be magenta.

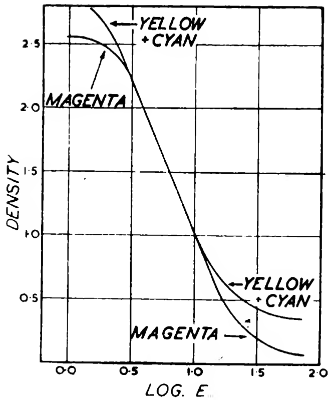


Fig. 3.

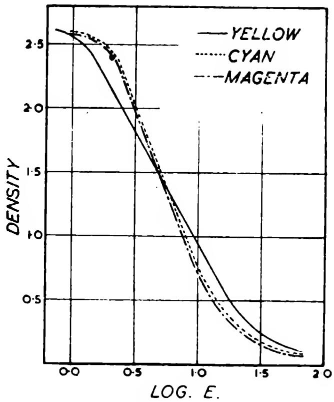


Fig. 4.

A few experiments with an out-of-balance transparency of this type and a few correction filters will show two things. First, the highlights and light tones of a picture are particularly liable to show a degree of unbalance which would be barely noticeable at higher densities. Second, the most satisfactory point of balance is a compromise depending on the subject matter; if there are flesh tones in the picture these should almost always be rendered as truthfully as possible. Certainly most attention generally needs to be paid to the balance of the lighter densities.

We have already seen how unequal emulsion speeds of the three layers in a tripack can produce density unbalance; a similar effect can obviously be given by use of light of the wrong colour temperature. If, for example, a daylight type emulsion is exposed in tungsten light, the blue-sensitive emulsion is under-exposed, and if the green sensitive emulsion is taken as being correct the red is over-exposed.

If we are compelled to make a duplicate or a colour print from such a transparency, we shall naturally make an effort to bring the reproduction into reasonable colour balance. Fig. 3 shows what is likely to happen. When the straight line portions of the curves are brought into balance all the important light tones are sadly out of balance.

So, while at first sight it may seem that if a transparency is not intended for viewing, but is merely an intermediate stage for prints, it might not matter if it is unbalanced for density of the three images. It does, in fact, matter a lot, and if it is necessary to use heavy correction filters to pull the balance back to neutral over the mid-tones, the duplicate or print—like the transparency bound up with a correction filter for viewing—will tend to have highlights the same colour as the filter used.

Density balance is, however, a fairly simple fault which can be compensated for at the exposure stage by anyone capable of interpreting the results of a test exposure and choosing colour correcting filters accordingly. Clearly this system can only conveniently be operated with those materials which can be processed by the photographer himself.

It should also be noted that it is possible to effect some correction in user-processed materials by changes in the processing times or formulae—provided that such changes are predictable and controllable.

In the case of colour negative materials it may well be that the manufacturers allow wider tolerances than they could for a reversal material. That this is so is suggested by the very wide range of correction filters employed in most of the negative-positive colour print procedures. It would seem more likely that improved results could be obtained by exposing through an appropriate correction filter, thus so obtaining a more perfectly matched set of characteristic curves on the three colour records. The alternative of attempting to effect correction at the printing stage by high density filters inevitably gives prints the highlights of which tend to be of complementary colour to the correction filter used.

Crossed Contrasts

Unfortunately the simple case of poor density balance is by no means the only fault that may be found in a colour tripack material. Unbalanced contrast is not uncommon and can be far more disturbing.

Let us take for an example the case of a yellow image which is lower in contrast than the other two. In a reversal film where the mid-tones are balanced to a neutral grey the higher densities will then not have enough yellow in them, that is they will be too blue, while the light tones will have too much yellow density as shown in Fig. 4.

With a material which produces this sort of result, exposing through a correction filter is of no real help. If a yellow correction filter were used over the lens in making the exposure it would simply move the yellow characteristic curve as a whole as shown in Fig. 5 and neutral balance would be achieved only in the high densities, giving shadows approximately correct in balance. The whole of the remainder of the picture would be far

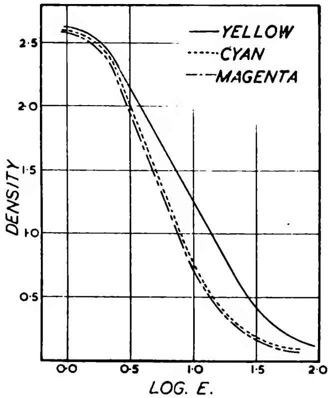


Fig. 5.

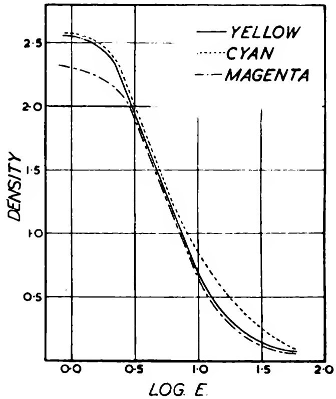


Fig. 6.

too yellow. Obviously the use of a complementary blue correction filter would bring the lighter tones into balance but all the heavy densities would then be far too blue—the shadows would probably be bright blue. There is no filter which will correct this type of result, and it can, of course, occur when any one layer has different contrast to the other two.

It will be seen from the above description and the characteristic curves that *where the emulsions of a tripack are not in good contrast balance the colour rendering can only be correct at one level of density.* All other densities will show poor colour reproduction. Just how noticeable this will be depends, naturally, on the degree of unbalance of the contrasts and on the subject matter of the picture.

Difference of Curve Shape

There is another, and perhaps more complex, form of colour unbalance which is generally a manufacturing problem, although it may be caused by age or poor storage of the film. Different curve shapes for the three colour records can give a lack of balance at some densities only.

To make three emulsions using different colour couplers and sensitisers which give matching colour images at all densities from toe to shoulder—possibly after reversal processing—is quite a difficult proposition. Most batches of any present-day tripack do, in fact, give acceptably balanced images and this is indeed a tribute to the skill and research put into their manufacture.

Nevertheless different curve shapes do sometimes occur and the resulting characteristic curves could appear as shown in Fig. 6, a hypothetical example shown somewhat exaggerated for clarity. Here the straight line portions of the three curves are well matched but the magenta falls off much too soon to a long, flat shoulder. Also the cyan emulsion has a toe which sweeps up quite gradually to meet the straight line at a relatively high density.

There is clearly nothing that can be done with a picture made on such a material once it has been processed—or even if the result could be predicted before the film was processed. There is just no way of restoring gradation which does not exist in any one layer of the film. Eliminating these errors would be just part of the development work that must go into any tripack material before it is marketed. Subsequently the materials must be as carefully stored as possible and in accordance with the individual manufacturers recommendations.

Once a material has been made things keep changing; emulsions, sensitisers, and couplers are all to some degree unstable, and processing, even in the hands of those who have much experience and take every care, often seems to be a rather uncertain factor so far as colour balance is concerned.

But above all, an understanding of the nature of the colour image is essential to evaluate the results obtained on tripack material. Few photographers will care to go as far as measuring colour densities and plotting their own colour characteristic curves, but an appreciation of the nature and significance of these curves will make it easy to analyse just what has happened to cause a colour picture to be off balance in any given way. Knowing this it is possible to say if it is a fault inherent in the material, and if not, how it may be corrected before proceeding with further photographs.

ORGANS— IN PARTICULAR

By Gilbert Benham

For many years I have made a thorough study of organ and architectural photography as my main hobby. My enthusiasm for the instrument is unbounded, and I have written many articles on organs from a tonal standpoint.

Although but an amateur, I have often been amazed at the illustrations that find acceptance by our newspapers, which show a complete lack of artistic feeling for either lighting or composition; and many of the professional's products in their windows exhibit various faults of a similar nature. The excessively heavy shadows that are everywhere to be noticed, the casual arrangement of people into one long, precise row, could be so easily avoided by a little care.

As an off-shot to the above specialised subjects I have for some years studied the photography of organists seated at their console, an even more difficult " pastime ", for it often happens that ideal lighting is impossible on account of lack of room.

I appreciate the fact that buildings cannot be altered to help the photographer, but a great deal can be done to overcome faults by seeing that arches do not lead out of the composition, nor their tops come towards the sides of the negative, especially when using a wide angle lens. In fact, all wide angle lenses require the utmost caution in all architectural work. I am sure that some artistic feeling is all but essential in all branches of photography other than mere snap-shotting on the summer holiday.

Both organs and architecture demand the greatest patience, skill and *suitable* apparatus. In so many architectural photographs the view-point has been carelessly chosen, including badly proportioned and badly balanced objects

Mr.ConradEden. Taken at Durham' Cathedral organ with a 5.3 Dallmeyer Stigmatic lens at f/6. Good perspective in spite of the fairly wide angle ½-plate negative. Front swing.

which spoil the effect of the entire picture—the results of the operator's inartistic outlook.

Let us consider the apparatus first, for it must form the governing factor throughout all operations. Everything must be of the very highest standard throughout. I have come to the conclusion that too great a stress cannot be laid on this point. Nothing smaller than half-plate size is advisable for serious work. For consoles I use whole-plate when travelling conditions allow. It is futile to photograph consoles unless every word is clearly readable, so this means the employment of the very finest lenses; my list of " possessions " at the end of this offering will show how important this equipment is. Regarding the type of camera, it may be helpful to state that I use a hand and stand Sanderson of a fairly early pattern. There have been several different models of this most excellent make, but one or two very good features of the early models appear to have been discontinued in later designs. I consider the hand and stand type has advantages over the stand type, and I have adapted my camera to further movements, the cross front, the side-swing to front, etc. I maintain that this camera will do *everything* I require. I have taken many subjects which no other man has taken, which is wonderful credit to lens and camera. Obviously, the whole body-work must be substantial and perfect, or some part will not stand up to the unusual strain often inflicted.

A very high-rising front is absolutely necessary. (I have about 4-in. rise to my Sanderson.) It is fitted with a Kodak cut film back and six slides; also the normal plate back and six slides for plates. For my 3-in. wide angle lens I have made a sunk panel to avoid the bellows cutting off. This brings the lens inside the body. To obtain a very great fall of front I turn the camera upside down, and to hold it I have made an oak " sling ", much like a U, made of three strips of wood, one for the tripod top, the two others bolt to the sides of the camera and everything is rigid. The two side pieces are hinged to the baseboard and so are folding. In this manner the former rise becomes the fall of 4 inches.

On the brass plate that runs along side runners, I have drilled ½-in. slits so that the bolt which holds down the front will allow ample cross front if the front is removed from its runners. Similarly, when the front is thus freed the centre bolt will allow any amount of side swing, even to 90 degrees angle to the plate. Both these specially made movements sometimes become necessary when a lens will cover no more than the plate. The slightest swing front will cut off at two corners unless rectified by the cross front. My only regret over my Sanderson is that no wide-angle rack-and-pinion was fitted to this early model. So I have got over this inconvenience by clamping the front on to the dropped base-board, freeing the front, and then pushing it towards the plate and vertical there-

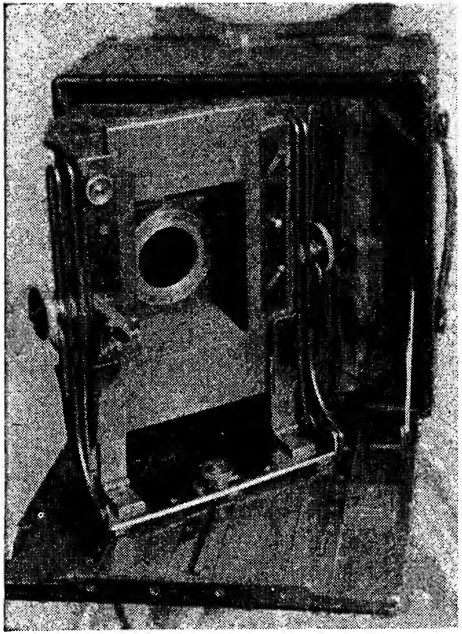
Dr. C. H. Moody. **Taken at Ripon at a distance of about 3 or 4 ft. at the top of an iron spiral staircase. Impossible to arrange suitable lighting, which had to be tied to the top rail of stairs a few inches from camera. Part of all four manuals is shown. Probably my most difficult subject. ¼-plate negative. 4-in. Meyer.**

with. By using the rack-and-pinion of the dropped base board, I obtain the convenience I require for wide angle work !

My whole-plate camera is a Hare, in new condition. For its wide-angle movement I have made a kind of wood-metal trough which takes the detached front. This fitment is then bolted to the rack-and-pinion front extension, with which it moves when the back is pushed far forward. My side swing is obtained by the back. The rise of front is 6-ins.

I do not think much need be said about lenses, for my list will explain itself. Nearly all my organ work relies upon wide-angle lenses, and it may be observed that many of mine differ by only a small degree of focal length. This is because with short foci small parts of an inch are of much greater consequence than with fairly long foci. My very old Wray R.R. wide-angle working at f/11 is a really wonderful little lens, covering a half plate with ease. The Rodenstock of 125 degrees is another extraordinary lens, covering whole plate, although I have not yet been obliged to resort to it on a plate of such size. The 4-in. Meyer will not cover a whole plate into the corners, although it very nearly does so.

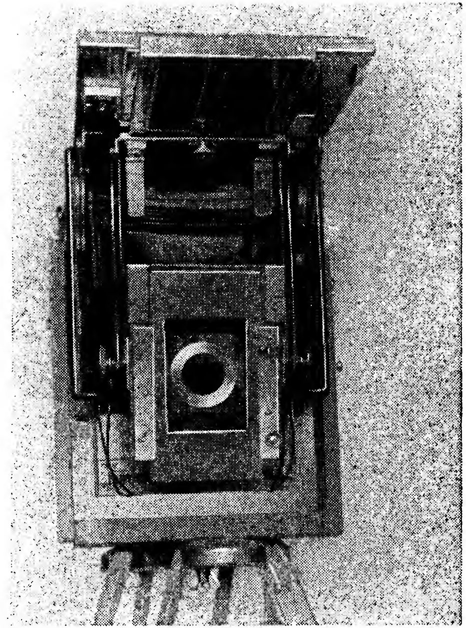
There is another important question that is frequently disregarded, the lighting of the whole picture. Here, again there are circumstances over which we have little or no control, but many instances exist which can be much improved by a little care, and a one-sided effect avoided to a surprising degree. To avoid heavy shadows on the opposite side to strong high-lights, the firing of one flash-bulb *without* reflector (or with a perfectly flat, large white card) at some yards away will solve the problem of uneven lighting. It is necessary that a strong, concentrated *beam* from the flash be avoided at all costs in order not to obtain a patchy result. A word of warning is prudent at this stage against over-doing the flash, which would give an unrealistic effect; e.g. a roof should not be better lit than the floor or arches. Only by long experience can the right answer be found, and then often it is discovered only after tests of the actual conditions. As an instance of this particular hazard I would quote the north case of St. Paul's Cathedral, London. This is best taken when good sunlight is on it, but the shadows cast on the eastern side of the carved images are very dense indeed. I photographed this case long before flashbulbs were invented; I may take it again some



½-pl. Sanderson showing swing-front modifications

On the left the front of the Sanderson is seen removed from, and resting on, the baseboard runners. The front can thus be side-swung over a wide angle, and clamped by the central screw. The hole for this screw has been enlarged to a slot, permitting the cross front necessary when using the side swing. This photograph also shows the sunk lens panel for the 3-in. wide-angle lens.

On the right the camera is seen mounted upside down in the oak "sling" which is screwed to the tripod. The screws holding the camera are staggered, so that the camera cannot tilt around the holding screws.



Sanderson upside down in oak "sling" for great fall of front.

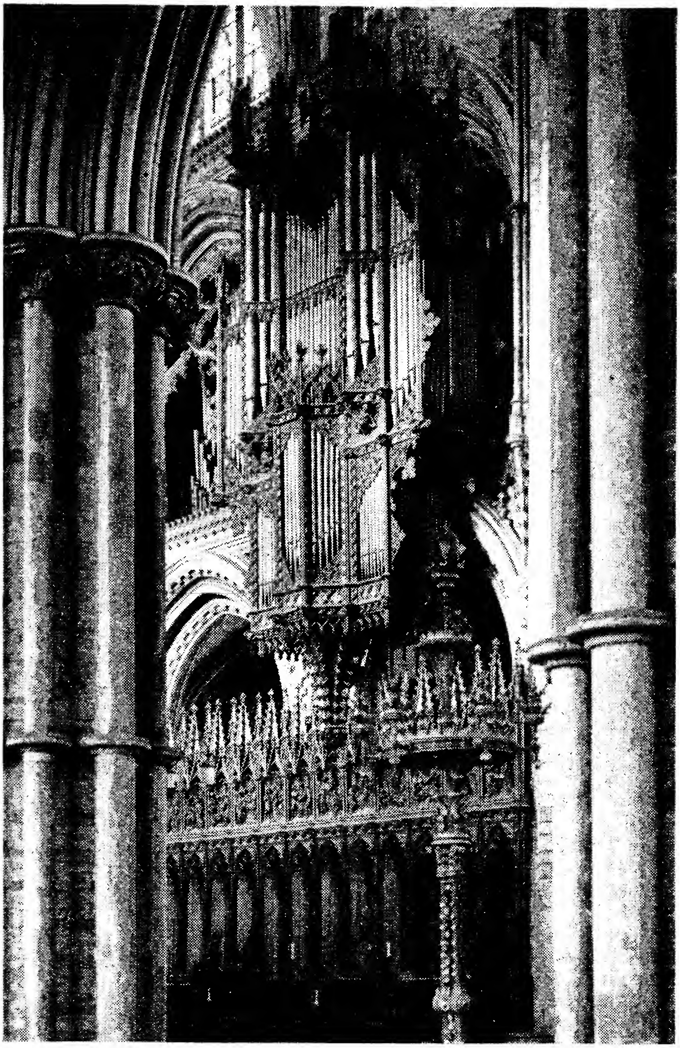
fine day with better results! With architecture it is wise to use always as long a focus lens as will obtain what is required, and a temptation to crowd in too much subject is a sin frequently committed. An exception to this rule may be Durham Cathedral nave, which has several styles of Norman work that look quite well on one negative. Chairs which crowd so many churches will not appear so broken-up if the camera is placed just higher than their backs; a couple of feet or less will meet the case; but it is infinitely better to remove some or all of the obstacles and show the complete columns.

So much depends on the colours contained in most windows that I feel unable to offer useful data. Windows of any kind are a serious problem in all branches of photography. To reduce exposure by using flash powder is one way of overcoming halation to some extent, but no certain method is apparent to me. In this connection I think cut films are preferable to glass plates, although " rubbing down " the intensity is more hazardous with films. When I was a boy there was a plate marketed by the Paget Dry Plate Company known as XXX. I believe it had three distinct emulsions, for the express purpose of dealing with window halation. It has been discontinued for many years, and I have never tried it. It may have failed to reach its ambition!

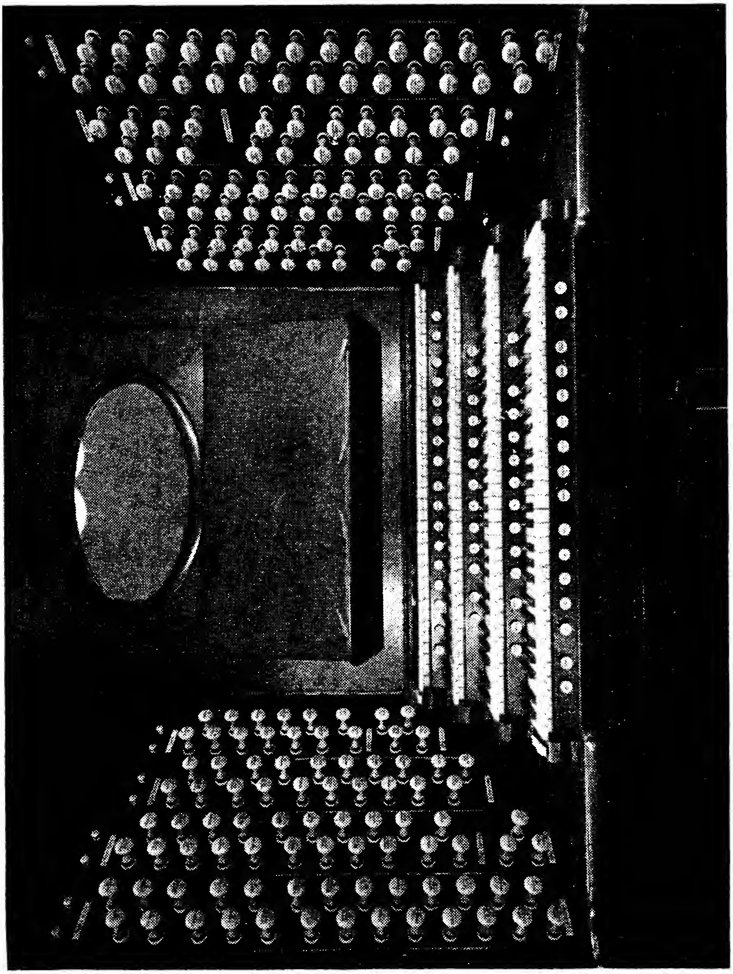
For my Photofloods I use a Kodak stand which I consider to be much the best. Extra arms can be obtained and variety in direction of lighting can be thus obtained. I have made yet another arm, of greater length. This further enhances my lighting effects and will extend well to the other side of my camera. For reflectors I prefer dull-finished electric light shades obtainable from Woolworths, but they must be backed with black paper if placed before the camera.

An invaluable accessory for slippery floors is a home-made " spider " consisting of three strips of wood bolted together at one end, with the three arms pointing outwards from the centre. Down the length of each a series of small holes are bored, into which the spikes of the tripod legs can find secure anchorage: a simple accessory costing literally nothing, but on occasion worth its weight in gold.

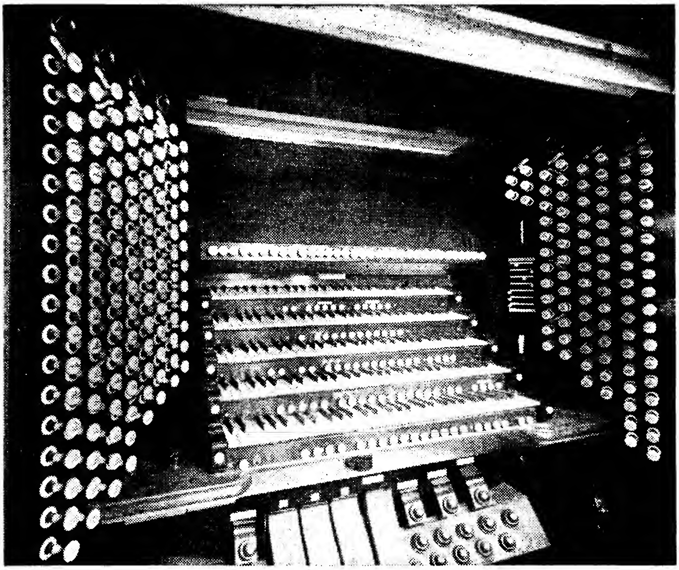
As my negatives must be of soft gradation I prefer Azol to any other developer.



Ely Case. Rise of front about 4-in. Very bright window behind top of case. Lens Zeiss W/A 5½-in. Protar. Stop f/45. ½-plate negative.



Royal Albert Hall, London.
Taken with 5½-in. Zeiss W/A Protar at f/45, every word being critically sharp. Very good perspective over the whole plate negative.



Liverpool Cathedral. Distance from choir keyboard to camera about 4 ft. Lens, Hugo Meyer 4 in. f/9 series. Stop f/32. Every name on knobs readable. Whole-plate negative.

LENSES

3-in. Wray wide-angle R.R. f/11. 3⅜-in. Rodenstock Pantogonal No. 1. Angle 125 degrees (an anastigmat of the highest order). 4-in. Meyer f/9 Series Aristostigmat Anastigmat. 4½-in. Zeiss W.A. Protar f/18. 4¾-in. Goerz Series III f/7.7. An early but wonderful old lens. Pre-Dagor, whose covering it exceeds. 5.3-in. Dallmeyer Stigmatic f/6 in shutter (for portraits). 5½-in. Zeiss Protar f/18. 6½-in. Dallmeyer f/6 Stigmatic in shutter. 7-in. Zeiss Protar f/18. 7¾-in. Zeiss Protar f/10. Very early, Waterhouse. 9-in. Ross Symmetrical f/5.6 for portraits mainly, but will do anything else! 10-in. Zeiss Protar f/18. 14-in. Ross Symmetrical f/8. 14-in. Busch Aplanat f/6: for portraits.

MASKING IN MULTILAYER MATERIALS

By Keith M. Hornsby, A.R.P.S.

Although straightforward negative-positive and double reversal colour prints on paper have been well received by the general public—largely perhaps because of their novelty—the discriminating observer is not satisfied. Colours are generally too dull and the reproduction of some hues is unsatisfactory. No dyes are perfect, and those in the azo methine group produced by colour development are among the least satisfactory. Fig. 1 shows the absorption curves of a typical set of dyes used in a colour development multilayer.

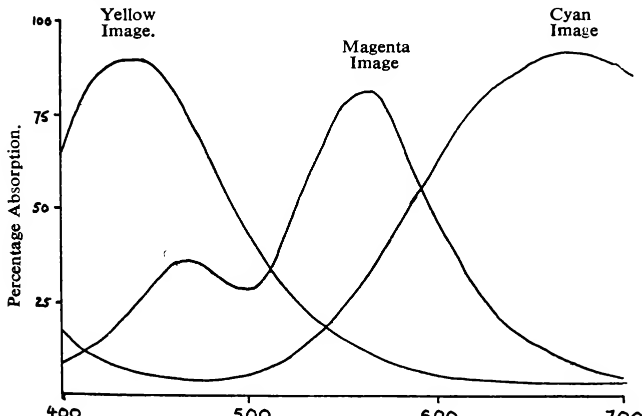


Fig. 1.

Ideally the magenta dye, for example, would transmit all blue and red light and absorb all green, but in practice only 60% of blue and 90% of the red are transmitted, whilst the green absorption is not perfect. It is not only these unwanted absorptions of blue and red light which reduce brilliance and colour accuracy. The overlaps between the curves further reduce brilliance, and the sharp peaks in the curves produce false colour emphasis. The effect of the sharp absorption maxima and minima must be tolerated, but considerable improvements in brilliance and colour accuracy can be made by the technique of masking.

Saturation Masks

If a set of colour wedges, which when superimposed give a grey wedge, are separately measured, each through red, green, and blue filters, nine curves can be plotted which can be divided into two groups: the principal curves i.e. the blue absorption of the yellow dye, the green absorption of the magenta dye and the red absorption of the cyan dye, which are the desired absorptions; and the secondary curves which are the undesirable absorption. (Fig. 2).

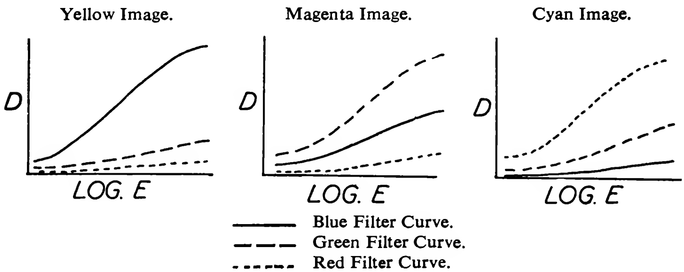


Fig. 2.

If we add together the principal curves and the secondary curves separately for a neutral wedge we should have two curves each representing more or less neutral images composed of the wanted and unwanted absorptions. (Fig. 3).

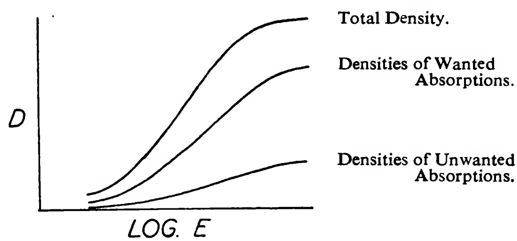


Fig. 3.

In the case of a neutral wedge the curve of the unwanted absorptions could not be separated from that of the desired absorptions, but in the case of a coloured object the effect would be equal to having a coloured image with a weak neutral image superimposed upon it. The effect of adding grey to all colours would be to reduce their brilliance—to degrade them.

In a typical case, if the total image contrast is 1, then the contrast of the combined principal absorptions may be 0.75, and that due to the secondary unwanted absorptions, 0.25. If the curves apply to a negative, then this degradation can be corrected by producing a black and white positive of contrast 0.25 and registering it with the negative. This will of course reduce the overall contrast, so the printing material must be made harder to restore the gamma product. The contrast of the silver mask can, with advantage, be increased to over-correct the negative and so compensate in some measure for the degradation produced by the dyes in the print material.

It is not practicable, however, to use a mask with a high enough contrast to correct completely both negative and positive. Very contrasty negative materials which could have their contrast reduced by the mask, and contrasty printing emulsions both suffer from poorly shaped characteristic curves, which increase the difficulty in manufacturing balanced materials.

Colour Correction Masks

The curves of the trichromatic analyses of the yellow, magenta, and cyan image dyes (Fig. 2) show that the blue absorption of the magenta image dye and the green absorption of the cyan dye are considerable. To compensate for these imperfections in the production of a neutral balanced print, the yellow must be reduced to compensate for the apparent yellow in the magenta image, and the magenta must be reduced to balance the apparent magenta in the cyan image. In a colour picture therefore, the yellows are weak, and the reds too orange and also rather weak, whilst the greens are bluish. As reds are generally very pure and saturated, a slight loss in strength and quality is not serious, but in the case of greens and yellows, whose purity and saturation are less, the loss is more apparent. To illustrate the principle of coloured image masking we will take the worst offender—the magenta image—as our example. As we have seen, a trichromatic analysis of a magenta step-wedge would give us three curves. The red filter curve is so flat that it can be ignored, but the blue filter curve has an appreciable contrast and would produce a definite unwanted image in the blue sensitive layer of the print material i.e. a yellow image from the green recording layer.

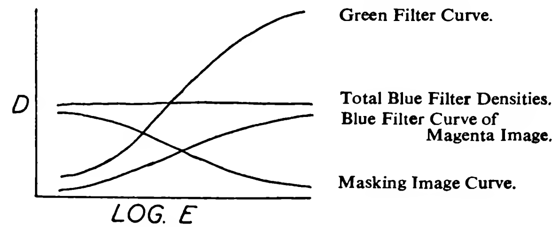


Fig. 4.

In the same way that the unwanted neutral image of a colour negative can be cancelled by the addition of a neutral positive image, this unwanted blue absorption of the magenta dye image can be cancelled by a corresponding image of opposite sign, that is a positive blue absorbing—or yellow—image. (Fig. 4.)

The high green absorption of the cyan dyestuff can be corrected in an analogous manner, but using a low contrast magenta positive from the red record as a mask. The colour distortions produced by the excessive green absorption of the yellow dye image could also be corrected by means of a magenta coloured mask, but as the imperfections of the yellow dyes are relatively slight, it is not at present considered necessary to correct them.

Masking in Practice

Obviously the types of masks which have been described could be easily made and registered with the negative or transparency to be printed. For motion picture work, where registration can be accurate and automatic there would be no difficulty, but for " one-off " still pictures, such a method, for routine work at least, would be quite impracticable if registration were a manual operation.* The problem then

*Kodak have patented a method for the automatic registration of masks by sealing the original in an impermeable, transparent and sensitized envelope so that the processing of the mask can be carried out without disturbing the register after printing the mask.

is to produce a masking image or images in the multilayer itself.

For silver saturation masks the solution is relatively simple. After colour development the silver image is removed, or converted to a relatively insensitive silver salt (the ordinary ferricyanide-bromide bleach does this). The whole film is then exposed to light of sufficient intensity to make the undeveloped halide developable (but not the bleached silver image), and black and white development will then produce a positive mask in perfect register with the negative dyestuff images. The contrast of the mask can be controlled very easily by the choice of black-and-white developer and the time of development.

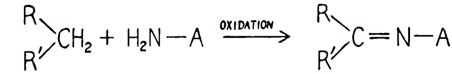
Refinements of this technique have been patented by General Aniline (Ansco) and by I.C.I. The general principle is to prevent the formation of a silver mask in the top (blue-sensitive, yellow image) layer. If a compound is included in the developing solution which will form a less readily developable salt than silver bromide, and if the concentration is such that its action is more or less restricted to the top layer, due to local exhaustion of this compound, then development will be restricted to the lower layers. Ansco have gone one stage further by claiming the use of a yellowish stain (such as that produced by sulphite-free pyro developers) instead of, or in addition to, the silver masking image. These images will tend to behave in the same way as coloured masks, although they will not be produced differentially in the appropriate layers, and so will only give approximate correction of colour.

Integral Colour Masks

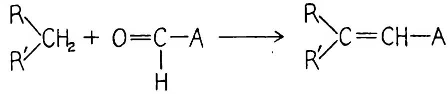
The colour couplers used in contemporary multilayer materials fall into the general category of compounds containing a reactive methylene group with the structure R—CH_2—R′ where either or both R and R′ are groups which " persuade " the methylene group to lose its hydrogen atoms and react with other compounds.

Under suitable conditions, compounds of this type can produce three classes of dyestuff.

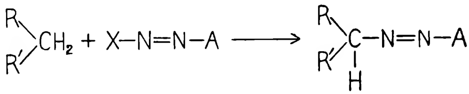
1. Azomethine dyes by reaction with oxidized aromatic amines



2. Styryl dyes by condensation with aromatic aldehydes



3. Azo dyes by reaction with a diazonium compound.



It would seem possible to use a coupler which is not mobile in the emulsion layer to produce two dye images—one, an azomethine dye image together with the silver image and the other a styryl or azo dye masking image produced from the residual coupler. The masking image would be, as required, of opposite sign to the image associated with the exposed and developed silver grains. (Fig. 5).

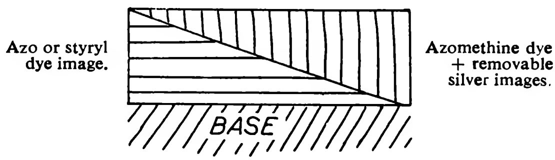


Fig. 5.

It is in fact possible to bathe an exposed and processed multilayer in a solution of a diazonium compound or of an aromatic aldehyde, to produce masking images. It is fortunate that compounds with the reactive grouping —CO—CH_2—CO—i.e. yellow couplers, produce neither azo nor styryl dyes with the compounds which will give yellow azo or styryl dyes with pyrazolone magenta couplers. Unfortunately no magenta styryl dye can be produced from a phenolic cyan coupler, but suitable azo dyes can be formed to give effective masking images. A further method is to incorporate passive diazonium compounds in the emulsion layers and to activate them to form the masking images.

Coloured Coupler Methods

There is a further remarkable property of some of the azo and styryl dyes which are formed from the couplers used in colour photography. If they are incorporated in a silver halide emulsion which is coated, exposed, and colour developed; where a silver image is formed, and the oxidation product of the developing agent produced, the azo or styryl dye will be split, and the azo methine dye will be formed. This is at present the most straightforward method of producing integral colour masks. The after treatment necessary to form the masks is avoided, and it would appear that the same processing procedure can be used as for unmasked negatives. The manufacturer of course has his problems, but the man who uses the material buys the one which is for him the most convenient and satisfactory, regardless of the manufacturing difficulties.

No names of patentees have been given in this section although many exist. In fact so many specifications, with overlapping claims, have been published on the subject of colour masking, that it is impossible in this confused situation for a technical student of patents to give any opinion as to the validity of the various claims. That decision can rest only with the Comptroller of the Patent Office or with a High Court Judge.

NATURE PHOTOGRAPHY WITH ELECTRONIC FLASH

By JOHN WARHAM, A.R.P.S.

The introduction of electronic flash some years ago was an event of tremendous interest to nature photographers, and sufficient experience has now been gained with the device to make possible a considered appraisal of its applicability to the photography of wild life in general. A good deal of the initial over-enthusiasm has abated, and it is now apparent that electronic flash by no means supersedes older and well-tried methods, but rather offers the nature worker an additional tool, one which greatly extends the range of subjects that he can record successfully. As with any other technique, the most successful exponents have been those who understand the inevitable limitations; it is all too easy to produce unpleasant and unnatural results with electronic flash.

For good reasons birds have always been very popular with nature photographers, and workers in this field were quick to realise that for them high-speed flash was a development of almost revolutionary importance. Up to that time most of the finest bird portraits had been taken at quite long exposures, and the photographer had to possess considerable skill in gauging the correct moment for opening the shutter or spoiled results due to the subject's movements were likely. Even highly skilled exponents accepted that as much as 80 per cent of their exposures might be ruined through this cause, the proportion of failures being governed primarily by the temperament and behaviour of the particular species or individuals under study. A duck, placidly covering a clutch in some reedy retreat, was unlikely to move during the opening of the shutter; a tit, teetering about on a branch, was seldom still long enough for any speed lower than 1/25th sec. to offer much chance of success. Thus, to obtain a characteristic series of pictures of the many small and restless species a not inconsiderable expenditure on material was involved For a variety of reasons the miniature camera with its greater depth of focus and possibilities of using faster

Fig. 1. Barn Owl.]

shutter speeds was not the answer, not at least for those whose ultimate aim was a 20×16 print. But with a flash duration of the order of 1/5,000-1/10,000 sec. the subject's movements would be immaterial and wastage of plates or film should be correspondingly less.

At first there was an understandable tendency to exploit the speed of electronic flash, and a spate of close-up shots of birds in flight appeared. Novel and dramatic effects were secured with comparative ease, striking wing positions were shown where the feather de ail was retained with a clarity that had previously been impossible. The advent of such pictures was not universally applauded; some nature photographers criticised the results on the grounds that the birds looked unnatural, that the postures depicted were far removed from ordinary experience. Here they were undoubtedly right, for the camera was being used to reveal movements far too fast for the eye to detect in detail; if some of the positions appeared impossible and extravagant they were nevertheless revelations of fact—though not necessarily of any pictorial merit. A more serious objection arose from the fact that when working in daylight the bird-flight photographer had to use a fairly high shutter speed, say 1/200 sec. or more, in order that only a single image appeared on the negative, that due to flash alone. With longer shutter speeds double images would often be apparent—the sharp primary image being marred by a hazy secondary image due to daylight registration. And, unless there was a solid background of foliage, a wall or something of a similar nature close behind the bird, the rapid fall off in illumination resulted in practically no detail in the background whatever. In a print this came out as a uniform black or dark grey tone. The critics had certainly strong grounds for complaint when they saw a diurnal species like a robin or a chaffinch portrayed as if flying through the depths of the night, for one of the cardinal requirements of a satisfactory natural history photograph is that it should be an accurate and truthful representation of the subject. Where owls were concerned however, the black background was quite authentic and some extremely fine results were soon being shown by various workers both in Britain and elsewhere.

At the present time there is rather less emphasis on the recording of bird flight, though most of us like to include a few flight shots in a series of any given species; the tendency is more and more towards the use of high speed photography to catch fleeting behaviour formerly impossible to show satisfactorily. The feeding of a female linnet by its mate (Fig. 2) provides a simple example. Taken with the aid of two 100-joule tubes, the incident is quite easily recorded, and despite the extremely rapid, almost frenzied movements of the birds, the white pulpy food is clearly visible coming down the male's beak. It is in the recording of such incidents that electronic flash excels and will be used increasingly in the future. But for the portraiture of the less erratic species, especially if the aim is the highest print quality, it is doubtful whether any form of artificial lighting can improve on natural sunlight diffused by thin cloud.

The speed of electronic flash does more than enable rapid movements to be arrested, it also neutralises any

Fig. 2. Female Linnet being fed by mate.

movement at the camera end. When taking pictures by daylight and using slow shutter speeds some loss of definition often occurs despite the use of a sturdy tripod. Such softening of definition may arise in various ways: through vibrations set up by the shutter itself perhaps, and often by the wind straining against the canvas sides of the hide—a condition which it is very difficult to overcome completely. But with high speed flash camera-shake is impossible.

Where the nature worker contemplates the use of flash on any considerable scale an electronic unit will prove far cheaper than conventional flash bulbs, for modern sets are capable of giving long and reliable service without breakdowns. The flash tube scores over bulbs in several other ways, quite apart from the speed at which it operates. Birds take much less notice of the momentary flicker of the flash tube than they do of the far more blinding blaze of a bulb. Another advantage is that when working after dark, the flash tube, once set up, needs no further attention for the rest of the session, whereas a bulb must be changed after each exposure. This means that valuable opportunities for shots may be lost since replacement can only be made when the adult birds have departed; and far too often when reaching up to replace the spent bulb in the belief that the coast is clear, the alarm notes of one's quarry tell that every movement is perceived—and objected to ! This does not augur well for one's future success.

Of course the use of electronic flash is not unaccompanied by snags. There is the dark background problem already discussed. This can be overcome in various ways according to the circumstances. For example when taking " set piece " studies such as those showing perched birds coming to bait at a particular spot, a light coloured backcloth may be introduced, the subjects being conditioned to its presence before photography is attempted. At other times it may be possible to picture the bird against a natural background close enough to register satisfactorily. Often, when very rapid movements are not involved, it is practicable to employ a shutter speed slow enough to allow a daylight image of the background highlights to record. When taking birds at their nests the trouble can be lessened or eliminated by the careful selection of nesting site. Those most suitable are situated so that their owners will be shown in front of foliage, against a creeper covered wall, the trunk of a tree, or the ground itself—anything to avoid an impression of impenetrable gloom such as would be given, for example, if the nest chosen was in the fork of an isolated tree.

The weight of the unit is a decided disadvantage, the more so since one's gear has so often to be carried for long distances when working among mountains, on moors, or in foreign countries where roads are few and far between. It should be noted that many of the light-weight equipments coming on the market operate at quite low voltages and hardly come into the category of high-speed units; the flash duration they give is often only of the order of 1/1,000th sec. This is quite inadequate to arrest many of the movements of birds and far too slow for showing them in flight.

Owing to the high voltages built up by the circuit, the operation of electronic flash equipment outdoors can be dangerous in damp weather. In a climate so changeable as our own it is quite possible to set up the flash heads beside the hide only to find after one's photographic session is well under way that it is beginning to rain. Unless the unit is properly shower-proofed, flash photography must cease until dry conditions again prevail—and the equipment is absolutely dry as well.

Since bird-at-the-nest photography is so popular a few points which should be watched when using electronic flash in such situations may perhaps be dealt with. Choice of nest site is most important—as explained above. The site having been selected the hide is introduced by stages in the usual manner, but in addition to the dummy lens, dummy reflectors should also be provided. A couple of large tin lids nailed or tied to the top front corners of the hide serve quite well, but they must be secured so that they cannot move in a wind. Before any photography is attempted time should be taken to decide just where and how all the equipment is going to be placed and where the flash heads must be fixed in order that the nest shall be evenly illuminated. If only a single tube is to be used this will generally be placed close to and slightly above the camera. It always takes time to get settled into a hide, even when not using flash; it takes still more time to set up when the speedgun and its attendant gear is involved. This time factor may matter little in some fields of nature work but with birds at their nests the photographer's first consideration must be for the safety and well-being of his hoped-for subjects. Equipment must therefore, be assembled with the minimum of delay in order that the bird's activities are interfered with as little as possible. It will often pay to fix camera to tripod and flash heads to stands near to but not at the nest, so that the parent birds may carry on their duties undisturbed until the half-assembled equipment is finally moved into its pre-determined position The buzz of the vibrator will seldom be noticed by birds but where the nest is on the ground I generally stand the power unit on a pad or a sorbo rubber cushion so that no vibration can be transmitted through the earth. Inside the hide everything must be readily accessible, not least the shutter controls and setting lever. It is most desirable to allow the birds to settle down before making any exposures and if the shutter makes any noise at all, the tubes should be fired manually from the power unit once or twice so that the subject's reactions to the flash can be tested before they have to become inured to the additional click of the shutter. Hand and eye must work quickly when catching the birds' behaviour and on development it will be regularly found that despite overall sharpness some shots depict the subject in awkward positions. Only the better and more characteristic negatives should be printed unless the others have value for some special purpose.

To catch birds winging to and from their nests it is necessary to note the lines of flight taken during their approach and departure. Often a perch may be set up perhaps 6 to 8 feet from the nest where the adult birds will alight when coming and going. By focussing on a piece of string drawn taut from the perch to the nest the camera can be trained on a portion of the flight line. It is then merely necessary, after removing the string, to anticipate the bird's movements and to release the shutter as it passes the pre-determined position.

The stops required will depend on several factors, but with a 100-joule unit and high-speed pan material apertures larger than f/16 will seldom be called for; with a 200-joule outfit f/22 will be more usual. The flash factor of the particular unit employed should be determined by each worker to suit his or her developing and enlarging techniques. Once the flash factor has been ascertained then the intelligent use of a measuring tape will ensure the selection of the correct stop for each situation. At the printing stage one important necessity must be mentioned; as generally happens with flash, foregrounds tend to be over-exposed, in enlarging therefore, the foreground, and any other area which has caught the light too strongly, will require printing-in; a " flashy " effect must be avoided at all costs.

Speedflash bird photography need not be restricted to work at the nest. With a single flash-head fixed to a camera that had previously been focussed for a known distance, I once made a useful series of pictures showing birds sleeping—tracking them down at night in their roosts. The power unit was carried on my back and the hand-held camera manoeuvred for distance and position before tripping the shutter and firing the flash. Electronic flash may also be used to take birds at bait—the tits frisking about on the peanuts or starlings bathing by a puddle. There are endless possibilities; it is mainly a matter of observation and preparation and of having the time to take advantage of opportunities as they occur.

The application of high-speed flash to insect photography calls for a rather different approach on account of the small size of the subjects. It is a field in which as yet there has been little development and the comments in this section are therefore drawn mainly from my own experience. In the past the finest insect photographs have usually been taken under controlled conditions—indoors in artificial light. Working in the open on wild insects free to roam as they please the photographer has difficulties to combat on every hand—the restlessness and timidity of his quarry, the apparently ever-present wind which rocks his subject in and out of focus as it sits on leaf or flower and all the other difficulties associated with the taking of close-ups using a hand-held camera. Electronic flash has not only a future in the " insect studio " to replace photofloods, but greatly simplifies outdoor work. It should now be possible to make shots in the field of a quality generally equal to those turned out by the worker with controlled insects indoors. Out of doors the subjects can be active, in their natural surroundings and in movement.

Sleeping moths and similar lethargic subjects have never presented many photographic problems, but most other forms, bees, flies, beetles, butterflies, grasshoppers, to name but a few, are the very reverse of lethargic. Armed with a camera focussed for close-ups—the taking distance being from 12 to 18 ins. according to the focal length of the lens used and the size of the image required, and a single flash-tube synchronised to the shutter, the roving insect cameraman can interview and record much of the doings of such creatures as they go about their normal business in garden, wood, or hedgerow. The method consists in setting the lens for a definite taking distance and then bringing camera and flash head into position at that distance from the insect. Some guide for doing this is invaluable, and my own method is to attach a pointer to the camera protruding forward so that its end lies in the plane of sharp focus yet low enough to be just out of the picture area. This device greatly facilitates aligning the camera onto the subject with the minimum of delay.

Insects vary greatly in the ease with which they permit one's approach; butterflies are easily frightened, bees and wasps generally quite indifferent. As a general rule it is advisable to come up to the hoped-for subject quietly,

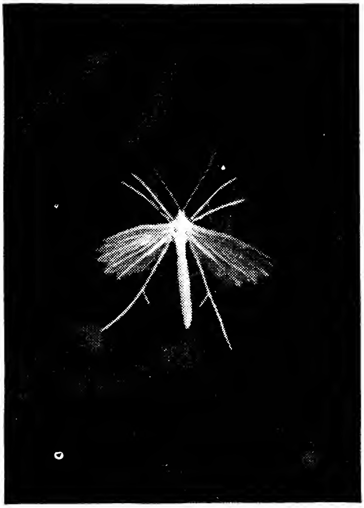


Fig. 3. White Plume Moth in flight. x2.5.

avoiding any sudden movements and on sunny days ensuring that one's shadow does not startle the insect. Where the latter is more or less stationary there may be time to compose the picture, and at least intruding objects in the background such as over-prominent leaves or twigs can be avoided.

High-speed flash can also be used to shoot insects on the wing, though the flight of insects is far more difficult to portray well than the flight of birds. In this connection it should be realised that an insect's wings may move at very high speeds, and the 1/5,000th sec. given by the flash from most small portable units may be quite inadequate to freeze such movements. Much depends on the position of the wings at the moment of exposure, for there are always parts of the path of movement where their velocity is low and where the flash can be quite effective.

In making a start at insect flight photography perhaps the easiest method is to use a tripod and to train camera and flash on some spot which is regularly visited by insects, firing the flash-tube as one of them comes into focus. Naturally the photographer must be able to anticipate the insect's movements and quick in releasing the shutter otherwise he will be too late to show it in action—it will already have alighted! Even at the small stops (f/32-f/64) possible at close quarters, the depth of field is shallow and rejects must be expected both through incorrect timing or anticipation and through the insect being out of focus. Much is possible in the garden. How many readers can call to mind a good photograph of a honey bee coming in to alight on a flower? Yet such a shot is quite within the grasp of anyone possessing a 100-joule unit and a shutter synchronised for flash and fitted to a camera that will focus down to about 12 ins. In the garden certain kinds of flowers offer a regular attraction for bees. The camera can be trained to cover the approach to one such flower (if thought necessary it could be baited with honey some hours beforehand), and with patience it should be possible to make a number of exposures as the bees come in for a meal. From these one or more should prove to be both sharp and to show the insect in an active and interesting posture. To avoid a gloomy background a light card can be set up a few inches behind the blossom.

Where the insect cannot be waylaid in this manner the camera must be mobile. In my experience the most practicable method is to fix the focus of the lens for a definite distance and to carry the camera with the flashhead attached and to use a pointer as a guide in the manner already explained. The insect is stalked and the camera brought into the correct position (either cautiously or swiftly according to the requirements of the moment) and the shutter released without hesitation. The moths which fly in the dusk of a summer's evening are quite good subjects on which to try one's hand; they may be taken as they hover before a flower or may have to be stalked and shot as they flutter through the foliage—as was necessary to get the white plume moth shown in Fig. 3. The small dragonfly illustrated in Fig. 4 was taken in the same way but this time in full daylight, a shutter speed of 1/200 sec. and a stop of f/50 ensuring freedom from duplicate images.

Wild animal photography has never been as popular here as has that of birds, mainly because so few animals have any fixed abode where a hide or other means of concealment would be of any use. Those creatures that do occupy more or less permanent quarters, foxes and badgers for instance, have been

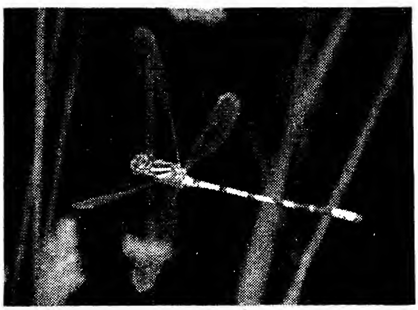


Fig. 4. Ischnura dragonfly in flight showing reverse action of forewings. x3.

well photographed, but especially where the smaller mammals are concerned true wild and free studies are rare. Most of the photographs that are reproduced in books and magazines show captive animals in surroundings got up to appear natural. The use of high-speed flash does not lessen the difficulties of getting to grips with such elusive customers, but it does ensure that their rapid

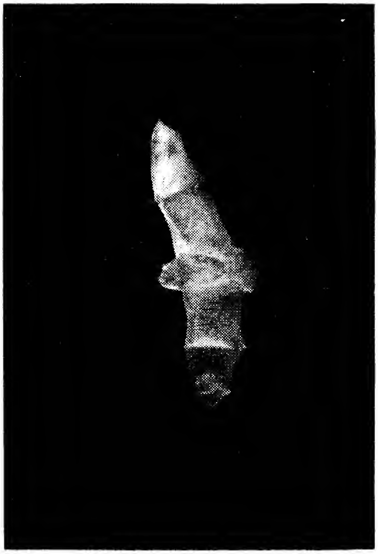


Fig. 5. Pipistrelle bat banking in flight.

movements do not mar the results. Electronic flash gives an excellent rendition of fur detail—an important asset where mammals are concerned.

Much wild life photography depends on chance and on the photographer's ability to take advantage of unexpected opportunities. Electronic flash often enables him to make the best of such chances; it lessens the danger of " near misses ". My shot of a pipistrelle bat in flight (Fig. 5) is an appropriate example. The animals would fly around my house on summer evenings and with the power unit connected to the mains, the lens focussed and the stop set in advance, it was possible to intercept the bats as they passed to and fro in the twilight. Although many exposures had to be made the final results fully justified the time and expense involved.

In conclusion it can be said that the application of electronic flash to the wide field offered by natural history photography has only just begun, and the possibilities for breaking new ground do not exist solely in the recording of subjects in their wild state such as have been described in this article; the method also opens up possibilities where the subjects are under some sort of control as with fish in aquaria or in the photography of protozoa and similar creatures through the microscope. Many new subjects await a photographer, from the leaping grasshopper to birds building their nests and the courtship dances of the midges by the river.

The photographic data relating to the accompanying illustrations, all of which were taken on high-speed panchromatic material, are as follows:—

Linnets; ¼-plate field camera, 16.5 cm. f/6.3 Tessar in Compur, synchronised at 1/200 sec. 2-100 joule lamps, f/22.

Barn Owl; ¼-plate field camera, 8½-in. Dallmeyer lens, open flash method several cameras used to record same flight position from different angles, one 100-joule tube, f/16.

Plume Moth; ¼-plate field camera, 16.5 cm. f/6.3 Tessar in syn. Compur, one 100-joule lamp, f/50.

Dragonfly; 3½ × 3½ reflex, 16.5 cm. f/6.3 Tessar in syn. Compur, shutter set at 1/200 sec., one 100-joule tube, f/50.

Bat; 3½ × 2½ reflex, 16.5 cm. f/6.3 Tessar in syn. Compur, one 100-joule tube, wire-frame finder, f/8.

COLOUR AND THE MEDICAL PHOTOGRAPHER

By NORMAN K. HARRISON, A.R.P.S.

Just short of a century ago—in 1857—Clerk Maxwell made the first full colour photograph.

The subject, a bow of tartan ribbon, was photographed three times, each exposure being made through a water filter, and from these separation negatives was made a set of monochrome positives. Using three lanterns the positives were each projected on a screen, the light from each passing through the water filter which had been used in making its negative, and the three images were superimposed. This, the world's first colour photograph, was demonstrated by Clerk Maxwell to the Royal Society two years later, and was the foundation of the additive systems of colour photography.

The opening of this century saw the availability of the Lumière Autochrome plate, exposable in any camera and producing a natural colour transparency viewable without any special apparatus. It was only to be expected that the medical profession, which had quickly taken advantage of the easier production of monochrome photographs to produce prints of clinical conditions and associated subjects, would seize with avidity this new method of portraying more naturally the conditions they wished to demonstrate. Some of the earliest examples of medical colour photography, a series of Lumière Autochromes of photomicrographs and gross specimens dated about 1908, were handed to Dr. Peter Hansell during his visit to America by Dr. Orrin Sage Wightman, of New York, for presentation to the Royal Photographic Society Medical Group. Two Lumière Autochromes taken by a physician, Sir James Purves Stewart, about 1912, of living subjects are now in the possession of Dr. Hansell at the Department of Medical Photography of the Westminster Hospital Medical School.

In 1935 came the first commercially offered subtractive material—Kodachrome, and this gave a tremendous impetus to colour conscious photographers. Ektachrome followed and offered user-processing, and with the commercial activity which ensued in the post-war years there came into use other processes—both additive and subtractive.

Practically every hospital which has a photographic department uses colour material in one form or other. In many its use has been reduced to a routine process with results as consistent as those in monochrome work. In still work the use of colour is mainly concerned with the provision of teaching material, though in some cases it is used for record work. Even then, it is often found that what has commenced as a record of a case becomes, on account of its medical interest and continuity, a useful teaching asset, and it is sometimes difficult to draw the line between what is teaching and what is record material.

In the sphere of medical cinematography the use of colour material is widespread. While many medical record and teaching films can be quite well and usefully made in monochrome there is one field at least—that of the operating theatre—in which colour representation is a *sine qua non.* Many of the present generation of medical photographers cannot remember the pre-Kodachrome era, when all films of operations had to be made on monochrome stock, and so cannot recall the excitement and pleasure on seeing the first 16-mm. colour films of surgical operations and of noting the tremendous advantage of colour over monochrome, and how it was now possible to differentiate without difficulty the tissues revealed by the surgeon's knife. Now the pendulum has swung the other way, with the result that often medical films are made with colour material which might just as easily—in fact more easily—be made with monochrome stock, and where it is admitted that colour was used not because it was essential but just to add interest to the film and to make its presentation more attractive. Well, there is no reason why colour should not be used to add to a film's presentation value, and indeed many films in which their authors take great pride need some boosting to bring their presentation even up to anything approaching professional standards. It should be remembered that colour cinematography is not cheap and that in hospital photographic departments where economic factors have to be considered it is possible to choose wisely when deciding the merits of monochrome or colour and to reserve the latter for those films which without colour would fail of their purpose.

An inquiry made of a number of hospitals as to the use of colour material has revealed some interesting facts. Despite what might have been expected there was a large majority—nearly two to one—using Ektachrome, in size ranging from $3\frac{1}{2} \times 2\frac{1}{2}$-in. to 5×4-in. but mainly quarter-plate, as against 35-mm. Kodachrome. Considering the extreme difference in price of the two, roughly seven to one (35-mm. Kodachrome at 1*s.* 5*d.* per frame, $4\frac{1}{4} \times 3\frac{1}{4}$-in. Ektachrome 10*s.* 3*d.* per frame), this contrast is rather surprising, but can possibly be accounted for on several grounds. Many hospitals are still using the standard $3\frac{1}{4} \times 3\frac{1}{4}$-in. lantern slides and have projection facilities for them, and since the quarter-plate Ektachrome can easily be cut to make that size slide there has been a natural tendency to continue that way. Further, the quarter-plate Ektachrome transparency will, without projection, make a very effective visual aid in itself, and by using a standard X-ray viewing box and a standard frame taking sixteen slides a teaching display of considerable value can easily be set up and, if desired, can be rapidly changed from time to time. While there is no doubt that 35-mm. Kodachrome or Ilford Colour or other comparable material will give first class results the undoubted worth of such transparencies lies in their projection value, combined with lightness, portability, low cost and unbreakableness. Despite these last three virtues it is rather significant that hospitals are willing to use the larger rather than the smaller size.

It has been found that in the majority of cases colour material is used in medical work more for the production of teaching aids than for the recording of cases. This is understandable. At the moment the variability of monochrome material is much less than that of colour material, and thus it is far easier to get a comparable series of monochrome photographs over a long period than it is to do the same thing in colour. By careful attention to technique it can be done, and one hospital photographic department gives 60 per cent of its colour work to records, 30 per cent to teaching material and 10 per cent to photomicrography. Other departments use colour to a certain extent for record work, but in the main for teaching purposes.

For the teaching of medical students the use of colour can be invaluable. In medicine colour is often of definite diagnostic value, and the physician, the surgeon, the morbid pathologist, the chemical pathologist and many others constantly use colour characteristics for identification purposes. The ability to perpetuate these characteristics quickly and with reasonable certainty and accuracy has given a new tool to the medical teacher—one which he has been quick to adopt. Thus it is that we find that teaching hospitals are gradually building up collections of colour slides so that the condition under discussion can be portrayed for the students to the best advantage. In medical museums, also, the colour transparency has taken a definite place, and beside the bottled specimens which once reigned supreme can now be seen colour reproductions of the clinical conditions associated with them.

In at least one medical museum in America the colour transparency has almost completely taken the place of the actual specimen, and although many will say that this is travelling too far it does show something of the way in which museum curators view the advent of the colour photograph. It is here worthwhile noting the great improvement made during the past few years in the production of the 35-mm. colour stereoscopic transparency. Considerable work has been done not only on the making of the transparencies themselves but also on the method of presentation, and at the last London Medical Exhibition there were exhibits of viewing cabinets containing 35-mm. colour stereo transparencies of clinical subjects which were absolutely first-class. The craze for 3-D which has infected the entertainment world has not so far infected those responsible for various forms of medical illustration, but one can envisage a medical museum in which in addition to the more conventional type of exhibit there are a number of such stereo viewing cabinets each containing a number of colour transparencies of clinical conditions associated with other exhibits.

There is still much to be done in this field of medical education, and undoubtedly the good work and proselytizing zeal of the medical photographer will have reactions on curators and others responsible for medical museums which will result in the greater use being made of this useful teaching medium.

It is not easy to assess the reaction of medical people to colour work. With some medical men there is a tendency to " go mad " on colour and to ask for it on every occasion, irrespective of whether the subject is a suitable one or not for this medium. Very few medical men have any real knowledge of colour material, though some do realise its limitations. Many are colour conscious and are prepared to listen to the photographer who suggests that better results might be obtained by the use of monochrome material. It is often a useful lesson to take a monochrome duplicate at the same time as making a colour exposure on a subject which, to the photographer, does not seem to demand colour, and to show the results to the medical man for comparison, for this demonstration is sometimes more convincing than any amount of discussion or argument.

In the main, it has been found that little special apparatus has been installed for colour photography, most departments using the existing cameras with perhaps some slight adaptation to take special sizes of colour material. In two cases, however, there has been brought into use a newly designed 35-mm. camera of bellows and monorail construction with interchangeable backs and a much wider range of movements than is found on the conventional camera of that size. As far as processing is concerned, the great majority of hospital photographic departments have their colour material processed either by the manufacturers or by commercial firms who specialise in this work, the comparatively small amount of work done not justifying the installation of the special processing apparatus with its attendant control complexities. In those cases, however, where the amount of work involved has justified processing on the spot it is noteworthy that a very high standard has been attained—quite comparable to the commercially finished product.

Very few hospital photographic departments produce colour prints as a routine. One department, however, uses the Agfa neg./pos. process to some extent, taking the negatives in the 5×4-in. size and having one contact colour print made by a commercial firm. The Director of the department, Dr. Peter Hansell, F.I.B.P., F.R.P.S., states that " When mastered, the Agfa neg./pos. process has several merits in selected cases. Where colour records are required to be stuck into patients' records (as with some of

(*Continued on page* 156A.)

PICTORIAL SUPPLEMENT

The following is a list of the photogravure reproductions arranged in the order in which they appear :

1. JOAN CRAVEN (Redbourn)—Finetta.
2. MARGARET HARKER (Harpenden)—Dr. J. L. Martin, Architect.
3. EMIL OBROVSKY (Austria)—Im Hafen.
4. LIM THENG HOON (Malaya)—Free and Independent.
5. L. LE GUAY (Australia)—Fashion Illustration.
6. E. GORDON BARBER (Harrow)—The Olive of Garda.
7. HOUSTON ROGERS (London)—Violetta Elvin in " Lac des Cygnes ".
8. J. T. KNIGHT (Midlothian)—Arabesque.
9. A. W. BRIGGS (Australia)—Mist.
10. R. G. FENNAH (Salford)—Shetland Sheep Dog.
11. W. M. WOLFF (Illinois)—Buddies.
12. N. G. YING CHUNG (Hong Kong)—Village Kids.
13. J. ST. AUBYN (Purley)—Pals.
14. FAN HO (Hong Kong)—The Spirit of Life.
15. HING-FOOK KAN (Hong Kong)—Shadow Show.
16. B. J. GOSDEN (Coventry)—Spring.
17. A. H. FIRMIN (E. Africa)—World's End.
18. S. C. HOLBROOK (Beaconsfield)—All My Own Work.
19. MATTĪ A. PĪTKĀNEN (Finland)—In the Gallery.
20. EVELYN WATERFIELD (W. Africa)—Adornment.
21. FRANCIS UHER (W. Africa)—The Happy Munchi Man.
22. LEOPOLD FISCHER (Austria)—Sämann's Vision.
23. BORIS DOBRO (California)—I Remember.
24. J. W. BARRAS WALKER (Canada)—No title.
25. J. MOLYNEAUX (Manchester)—Craft.
26. H. R. SAILORS (Oklahoma)—Calla Lilies.
27. WELLINGTON LEE (New York)—Modern Dance.
28. IVY M. HILL (Sutton Coldfield)—Mimi.
29. E. CHAMBRÉ HARDMAN (Liverpool)—Valeria Hanson.
30. W. FLOWER (London)—Percy Grainger.
31. F. JOHNSON TAYLOR (Norfolk)—Miss Elizabeth Hames.
32. T. H. MORRISON (Newcastle-upon-Tyne)—Steam Up.

Nos. 2, 8, 9, 22, 23, 25, 26, 27, 29, 30, and 31, from the Royal Photographic Society Annual Exhibition, 1953.

Nos. 1, 3, 4, 5, 6, 7, 11, 12, 13, 14, 15, 16, 18, 19, 28, and 32 from the London Salon of Photography, 1953.

Nos. 17, 20, 21, and 24, from the Institute of British Photographers Exhibition of Professional Photography in the Commonwealth, 1953.

FINETTA JOAN CRAVEN

DR. J. L. MARTIN, ARCHITECT MARGARET HARKER

IM HAFEN — EMIL OBROVSKY

FREE AND INDEPENDENT LIM THENG HOON

FASHION ILLUSTRATION L. LE GUAY

THE OLIVE OF GARDA — E. GORDON BARBER

VIOLETTA ELVIN IN "LAC DES CYGNES" HOUSTON ROGERS

ARABESQUE J. T. KNIGHT

MIST A. W. BRIGGS

SHETLAND SHEEP DOG R. G. FENNAH

BUDDIES W. M. WOLFF

VILLAGE KIDS N. G. YING CHUNG

PALS J. ST. AUBYN

THE SPIRIT OF LIFE — FAN HO

SHADOW SHOW — HING-FOOK KAN

SPRING

B. J. GOSDEN

WORLD'S END A. H. FIRMIN,

ALL MY OWN WORK — S. C. HOLBROOK

IN THE GALLERY — MATTÏ A. PÏTKÄNEN

ADORNMENT EVELYN WATERFIELD

THE HAPPY MUNCHI MAN FRANCIS UHER

SÄMANN'S VISION LEOPOLD FISCHER

I REMEMBER BORIS DOBRO

J. W. BARRAS WALKER

CRAFT J. MOLYNEAUX

CALLA LILIES H. R. SAILORS

MODERN DANCE WELLINGTON LEE

MIMI IVY M. HILL

VALERIE HANSON | E. CHAMBRÉ HARDMAN

PERCY GRAINGER — W. FLOWER

MISS ELIZABETH HAMES F. JOHNSON TAYLOR

STEAM UP T. H. MORRISON

(*continued from page* 155)

our irradiation patients) transparencies are better replaced by prints. Further, this process leaves a *negative on file* from which further colour prints, black and white prints *and* colour transparencies, standard or miniature, can be made at any time. First results are likely to be disappointing, and an understanding of the process is as necessary as close co-operation with the processing laboratory."

This practice is rather in line with the policy adopted by the University of Illinois Division of Service for Crippled Children, where at the Cleft Palate Centre photographs are taken with a direct separation fixed focus camera, and from the negatives produced dye transfer prints are made of the size required. The one-shot camera, of $3\frac{1}{2} \times 2\frac{1}{2}$-in. size, was specially made for intra-oral photography, and has the flash and mirror mounted on the camera. A removable wire finder of the exact size of the area covered extends in front of the lens and incorporates a grey scale built into the edge of the frame and hence appearing on the negative. From the negatives acceptable colour prints as large as 17×14-in. are consistently produced. Colour transparencies for projection are made by copying the prints on to Ektachrome film, and monochrome prints are made by printing from one of the separation negatives.

Reference must be made to the Johnson Colour Screen process, introduced a year or so back. This is a continuation of the Finlay process in which a monochrome plate is exposed through a taking screen carrying a pattern of red, green, and blue squares, 175 to the inch. After normal processing this negative is contact printed on to a high-contrast non-colour sensitive plate, and this positive is finally bound up with a Johnson viewing screen. The process was described and illustrated at the 1952 fourth annual conference of the Medical Group of the Institute of British Photographers in London by Mr. T. C. Dodds, F.I.B.P., F.R.P.S., of the Department of Pathology, University of Edinburgh, the foremost exponent of this system, and the slides he showed of photomicrographs and clinical conditions demonstrated admirably the possibilities of this process. Despite the simplicity of the procedure, the control which can be exercised at every stage, and the speed with which the final colour transparency can be produced the process has not apparently found great favour with medical photographers, and the number who are using it is very small.

The introduction recently of colour prints by Ilford Ltd. probably marks another step towards the complete colour service which ideally should be available to all medical photographers. At present these prints, about $5\frac{1}{2} \times 3\frac{3}{4}$-in. in size, can only be supplied from Ilford Colour 35 mm. transparencies. The process uses an integral tripack with reversal processing, on a white plastic base instead of paper. The price is 2*s*. 6*d*. per print with a minimum of four prints from one or more transparencies, and only a dealer service is available at the moment. Such prints as have been seen show good definition with a wide range of colour tones. A number of correspondents have stressed their need for the rapid and reasonably priced production of colour prints, and it is a common experience for medical men to ask whether colour prints can be had. There seems no technical reason, if $5\frac{1}{2} \times 3\frac{3}{4}$-in. colour prints can be had on a standardised basis from 35-mm. colour film, why, say, half-plate prints should not be had on a similar standardised technique from quarter-plate colour transparencies, which seems to be the size most commonly used by medical photographers who do not use 35-mm. One hospital photographic department records that they make approximately 7,000 monochrome negatives a year and 3,000 colour transparencies, and it is reasonably safe to presume that should a colour print service become available a considerable proportion of those 35-mm. colour transparencies would be offered as colour prints.

Should Ilford Ltd. make it possible for such prints to become available from other transparencies than Ilford Colour and from other sizes than 35-mm. then a large potential market will be opened up in the field of medical photography, and we may yet see the time when record work for case reports will be done with such prints instead of in monochrome, and it may be necessary for medical photographers and hospital administrators to revise the policy which governs the work of the photographic departments.

Never before in the history of photography have so many colour processes been available for the medical photographer as there are at present. Without any great mental effort it is possible to mention over a dozen processes from which the photographer of medical subjects may select one or more to delineate the subjects which face him day by day. Whatever form of illumination he may choose or may be compelled to use there is a colour process available for him; whether he be dealing with static subjects and the exposure time is immaterial or whether he is perforce compelled to use the shortest possible exposure to stop movement he can still use a colour process which will give him first-class results; and whether he wishes to make his records with the minimum of expense or to display his talents by producing large transparencies for display work to the most effective advantage, he is still well catered for.

The field of colour is wide, the scope of the medical photographer is great, and it now remains for him to use to the best advantage the facilities offered him and to see that he masters completely the medium with which he chooses to work.

User-Processing of Agfacolor and Ferraniacolor Reversal Films

From experience with pre-war Agfacolor C. Leslie Thomson felt that it ought to be possible to simplify and shorten the process as described in F.I.A.T. reports and other literature, without loss of quality, by working on two lines: (1) treating some of the solutions as expendable, and (2) giving intensive attention to clearing the film between baths. A third possibility, which might occur to those who have processed Ektachrome, the use of higher working temperatures, is not practicable with Agfacolor: 65° F. is the normal working temperature, and 67° should not be exceeded at any stage, or frilling of the emulsion is almost certain.

In commercial practice it is usually expected that working solutions should maintain their activity for at least a full working day, and that results should show no variation during that time. Also that any baths which contain relatively expensive ingredients should have a long life. For the smaller user, dealing with 10 or 15 oz. of solution, the cost of chemicals is only a matter of pence per spool, and keeping bottles of half-used solutions is probably more trouble, and certainly more unreliable, than making afresh for each film. Naturally, if made-on-the-spot solutions are to be used the formulæ should be simple and quick to compound.

Washing is, as several investigators have pointed out, not merely a matter of time and volume of water: it is primarily related to efficient interchange at the surface of the film. If the film can be given more agitation than is produced by being left in a tank with water running through it, the time can safely be reduced. Furthermore, if the active reagents of developing solutions can be " killed " or made more soluble with a stop bath, an even shorter washing may be entirely adequate.

Put briefly, the result of experiment along these lines is a method which takes under ninety minutes, including making up the developers and the final wash, and requires only five reagent baths. Two of these solutions can be stored indefinitely as working baths. Another is made up in a few seconds from concentrated stock. The two remaining—the first developer and the colour developer—can each be made up, from dry chemicals and a stock solution, in a matter of two or three minutes and are ready for immediate use. (That is, they do not require to be left to cool.) The results are strictly comparable with the best produced by the makers' processing, and it is easy for the user who wishes to do so to modify the colour balance and the contrast within quite wide limits.

With the exception of the colour developer precisely similar solutions and timings may be used for both Agfacolor and Ferraniacolor.

All the reagents used are available from any well-stocked photographic dealer, and indeed most of them will already be on the shelves of the serious photographer's darkroom.

The reducing agent in the first developer is amidol. Other reducers, such as metol and hydroquinone, can be used in various combinations and proportions, but none seems to give the same balance as amidol. Amidol introduces a slight complication because it acts in acid media almost as vigorously as in alkaline, and it therefore cannot be stopped or cleared by acid baths. It can only be removed by thorough washing.

Re-exposure is not critical in timing, but droplets on the back of the film can produce ring markings. If the film is re-exposed in air, water droplets must either be removed with a viscose sponge or prevented from forming by treating the film with a solution of wetting-agent. Neither of these is necessary if the film is see-sawed through a dish of cold water while under the lamp. The cold water has a useful second purpose: it allows a more intense light to be used safely and at shorter distances, so saving a few more minutes.

Clearing the colour developer from the film is considerably accelerated by following it immediately by a bath of dilute acid. This bath, also, has a secondary function: it hardens the gelatine and so avoids any risk of frilling or similar injury to the emulsion in the subsequent baths.

Acid, however, tends to produce a slight, temporary, loss of intensity in the cyan dye. This dye normally re-forms during drying of the film, but the restoration is made more positive by the addition of a small amount of borax to the fixing bath. The borax also stabilises the film against a similar bleaching of the cyan by the final wash, which can otherwise be quite troublesome with some water supplies.

Procedure

The processing steps are these:

First development	20 mins. at 65° F. $\pm \frac{1}{2}$°.
Wash (vigorous)	20 mins. at 55–65°.
Re-exposure (see below)... ...	1 min.
Colour development	12 mins. at 65° $\pm$ 1°.
Acid stop and clear	3 mins. at 60–65°.
Wash (vigorous)	7 mins. at 55–65°.
Bleach	About 7 mins. at 60–65°.
Rinse	1 min.
Fix and stabilise	About 3 mins. at 60–65°.
Wash	12 mins.

Before giving the formulæ, some points about the table above must be explained. Both developments should be carried out with frequent agitation. The film should be regularly agitated and not left stationary for more than about a minute. If continuous agitation is used, the first development may be shortened to 18 minutes. " Vigorous " washing means that the water runs through the tank briskly, the film is agitated frequently, and the tank completely emptied at least once every two minutes. The film should be handled in complete darkness—or kept in a light-tight tank—until ready for re-exposure. The re-exposure is most reliably performed by removing the film from the tank-spiral. A convenient light is a No. 1 Photoflood in a reflector about a foot above the surface of the water-trough (a half-plate dish filled with water not over 60°). The film, held at either end by stainless clips, is see-sawed under the lamp, each side receiving about 30 secs., and is then returned to the spiral. The film must be vigorously agitated in the stop and clear bath. Bleaching is continued until all traces of the browny anti-halo layer disappear from the film, allowing a chalky-blue colour to be seen through the back. Fixing is complete one minute after the blue chalkiness vanishes, leaving an inky-black appearance in the back of the film.

Formulæ

FIRST DEVELOPER:	
Sodium sulphite anhydrous	50 gm.
Amidol	5 gm.
Potassium bromide 20 per cent. solution	5 c.c. (=1 gm.)
Water to	1 litre
COLOUR DEVELOPER: AGFACOLOR:	
Genochrome (May & Baker)	3 gm.
Sodium carbonate crystal	100 gm.
Potassium bromide 20 per cent. solution	10 c.c. (=2 gm.)
Water to	1 litre
COLOUR DEVELOPER: FERRANIACOLOR:	
Genochrome	3 gm.
Sodium carbonate crystal	175 gm.
Potassium bromide 20 per cent. solution	5 c.c. (=1 gm.)
Water to	1 litre
STOP AND CLEAR BATH:	
Glacial acetic acid 50 per cent.	20 c.c.
Water to	1 litre
BLEACH BATH:	
Potassium ferricyanide ...	25 gm.
Potassium bromide ...	10 gm.
Water to	1 litre
FIX AND STABILISE:	
Sodium thiosulphate crystal (hypo) ...	200 gm.
Borax	10 gm.
Water to	1 litre

The dry ingredients of the first developer dissolve readily when stirred into water at working temperature. The carbonate crystals for the colour developer are dissolved in a small amount of hot water, which cools rapidly. The Genochrome is best dissolved separately in a small amount of cold water. The bleach should be made up with warm water, and the larger crystals crushed. The fix and stabilise bath is made with hot water, the borax dissolved first.

The stop bath is discarded after use. Both developers may safely be re-used within a few hours. The bleach and the fix and stabilise will keep for many weeks and may be used repeatedly until they become slow-acting. It is safe to wipe down the film with a viscose sponge before drying.

IMPORTANT: No heat should be applied in drying the film, unless by a strong current of warm—not hot—air.

Individual techniques of handling may cause variations in results, but the procedure described should normally give consistent results which closely match good commercial processing. With Agfacolor softer gradation may be produced by giving increased exposure in the camera and shortening first development. (This is also useful with out-dated material.) The yellow content may be controlled by varying the potassium bromide in the first developer: more bromide gives stronger yellow. The blue content may be varied by reducing or extending the colour development time: 10 mins. gives a warmer balance and softer rendering, while 16 mins. gives maximum blue and harder image.

Ferraniacolor is structurally very similar to Agfacolor. Also, in general colour rendering, gradation, resolution, and maximum density they are closely alike. But for the user-processer there is one important difference: extended colour-development time makes Agfacolor "colder", while it makes Ferraniacolor "warmer". In both cases the increase in overall density with extended time is quite small, but the colour balance alters markedly.

At present, Agfacolor Reversal is only available at a price which includes processing, and accordingly user-processing will only appeal to those who require finished pictures in the shortest time, or who prefer to have control in their own hands. In the 36-exposure length, however, the cost per picture is quite reasonable, and it is also practicable to cut the film in the darkroom and process a few exposures at a time without too great a loss of material.

The kit made by Johnsons for Ferraniacolor is excellent and reasonably priced, while the instruction sheet is a model of clarity. For the average user there is little point in using anything else. However, it may be that others share the writer's preference for formulæ of known composition, which can be made up freshly and in the quantities required, also, if necessary, varied to produce results closer to one's individual taste.

B.J., 1953, Aug. 7, p. 409.

B.J., 1953, Oct. 2, p. 518.

User-Processing Gevacolor Reversal Films

Gevacolor, although usually classified as an "Agfa-type" material, has a character entirely of its own. It is capable of strongly saturated colours, high resolution, a long scale, and a dense maximum black. These features are accompanied, not unexpectedly, by a marked sensitivity to processing variations. The timing of the two developments has to be quite critical if consistent results are expected. Some years ago, Gevaert made known the sequence and timing of their process, and their intention at that time was to provide kits for user-processing. Their present policy appears to be to keep processing in approved professional hands. This is doubtless prudent, but scarcely satisfies the colour worker who likes to have full control of his material —and to see results promptly.

The routine released by Gevaert occupied two hours and called for seven different solutions of undisclosed composition. In the 1950 Supplement to *Colour Transparencies* (Focal Press) C. Leslie Thomson presented a set of substitute formulæ which could be used to operate this routine. They gave reliable results with the original Gevacolor Reversal (which was not retailed in this country) and also suit quite well the new "R5" material which, in many respects, shows considerable improvement over the earlier film.

Intensive experimentation has shown, however, that even more satisfactory results can be produced with a modified process, using no more than six solutions and within a total time of seventy minutes. The general procedure is similar to that described for Agfacolor: the outstanding difference being the first development. With Gevacolor this has to be performed with an M-Q-solvent formula, which takes a little longer to compound than an Amidol developer but acts more speedily and can be cleared in half the time. Even if one allows ample time for weighing out and preparing the first developer, the whole operation, including final washing, can be completed in well under an hour and a half.

Made-up developer can be safely stored unused for several days, but for consistency in results it is better to use freshly prepared solution.

The use of 1 per cent. acetic acid as a stop-and-clear bath after both developments considerably simplifies the process, rendering any other hardening unnecessary—even with soft water supplies—and reducing the interval between colour-development and silver-bleaching from thirty-eight to ten minutes.

It should be clearly understood that the formulæ presented below are not substitutes for the official chemicals: they are designed and intended only for the routine described. The results produced may not be identical with those of official processing, but they should nevertheless stand comparison in respect of colour rendering, gradation, and effective speed. Should first trials show that any of these is unsatisfactory with a particular batch of material, simple variations in application provide a wide range of control.

The article in the August 7th issue of the *B.J.* (see p. 156D) should help to explain several features of the process, and the reader is asked to refer to it for amplification.

Procedure

The processing steps are these:

First development	14 mins. at 68° F. $\pm\frac{1}{2}$°.
Stop-and-clear	3 mins. at 60–65°.
Wash	7 mins. at 55–65°.
Re-exposure	1 min.
Colour development	12 mins. at 68° $\pm\frac{1}{2}$°.
Stop-and-clear	3 mins. at 60–65°.
Wash	7 mins. at 55–65°.
Bleach	About 7 mins. at 60–65°.
Rinse	1 min.
Fix	3 mins. at 60–65°.
Wash	12 mins.
Stabilise	3 mins. at 60–65° F.
Rinse	30 sec.

Frequent agitation is required during both developments: their timing is critical and may have to be altered to suit different batches of film. If light greys are rendered pinkish, first development should be extended by a minute or so: if greenish, curtailed by a similar amount. If the general density and contrast seem excessive, reduce colour development by one minute: if shadows are thin and browny, extend by one minute. (A difference of three minutes in colour development virtually halves or doubles the effective speed.) The pinkish cast in light greys—as in clouds, for instance—is at first glance similar to the stain resulting from incomplete clearing of the colour developer. The difference becomes obvious on closer inspection: true highlights—or fogged film-ends—are not coloured; the cast shows only where there is appreciable density of dye.

The film should be vigorously agitated in the stop baths, and if the washing-water is much below 60° the wash times should be extended by half.

Re-exposure—with the film under water and a foot from a No. 1 Photoflood—need only be given to the emulsion side of the film. In other respects handle exactly as for Agfacolor.

Formulæ

FIRST DEVELOPER:	
Metol	1.5 gm.
Sodium sulphite anhydrous	25 gm.
Hydroquinone	4.5 gm.
Sodium carbonate crystal	85 gm.
Potassium bromide ...	5 gm.
Potassium thiocyanate ...	3.5 gm.
Water to	1 litre
STOP-AND-CLEAR:	
Glacial acetic acid 50 per cent....	20 c.c.
Water to	1 litre
COLOUR DEVELOPER:	
Genochrome (May & Baker) ...	2 gm.
Sodium carbonate crystal ...	100 gm.
Potassium bromide	3 gm.
Water to	1 litre
BLEACH:	
Potassium ferricyanide ...	25 gm.
Potassium bromide ...	10 gm.
Water to	1 litre
FIX:	
Sodium thiosulphate crystal	200 gm.
Borax	10 gm.
Water to	1 litre
STABILISER:	
Formalin (Formaldehyde solution 40 per cent.)	25 c.c.
Water to	1 litre

In making up the first developer, the customary sequence is observed: dissolve metol first, then sulphite followed by other ingredients. Carbonate crystals are best dissolved in a separate small amount of hot water, (If desiccated—" monohydrate "—carbonate is preferred, this can be dissolved in cool water with the other ingredients: divide weights given by 2¼. If anhydrous carbonate is used, divide by 2¾.)

Both developers are best discarded after use, but may be safely re-used within a few hours if desired. Fresh batches of dilute acetic acid must be used for each stop-and-clear bath. The bleaching and the fixing baths may both be stored indefinitely and used until their action becomes slow. (See Agfacolor article.) Potassium thiocyanate is most conveniently stored as a 50 per cent. solution (50 grammes made up to 100 c.c.). For small quantities of potassium bromide a 20 per cent. solution is handier than weighing out the dry salt.

For making up 10 oz. (285 c.c.) quantities—as are often suitable for

20-exposure lengths of 35-mm. film—a sufficiently accurate conversion is given by multiplying the litre quantities by 0.3 and ignoring the third figure.

Apart from batch-to-batch variations, the optimum development times for individual methods of handling may differ a little from the figures given. These should, however, serve as a safe starting-point.

Finally, a gentle caution which experience shows it necessary to repeat: If you fail to get good results using unofficial methods and formulæ, don't expect any sympathy from the film manufacturers. Remember that the makers are entitled to make changes in the character of their product at any time without announcing the fact to unauthorised dabblers. You are on your own: good luck!

Editorial Note. The formulæ and times given above have given consistently good results in the laboratories both of the author and of the *British Journal of Photography*. However, it is entirely possible that different batches of film from those which are currently available in Britain may need some modification to either the developer constitution or timings along the lines suggested in the article. For the user of large quantities of film it would be good practice to purchase as large a quantity of the same batch number as possible and process a short test run before putting the film into use.

B.J., 1953, Oct. 2, p. 518.

Substitute Formulæ for Processing Agfacolor Negative Film and Agfacolor Paper

For those enthusiasts with an experimental turn of mind who wish to try their hand at processing Agfacolor negative film and paper, the negative-positive process for producing colour prints on paper, the following substitute formulæ worked out by R. J. Finn have been found to give results approaching the high standards of the official Agfa method, and are offered by the author as a starting point towards perfection.

Negative Film Processing

	Time, Minutes.	*Temp. °F.*
(1) Colour development	6 ($\pm$10 secs.)	68 ($\pm\frac{1}{2}$° F.)
(2) Washing (running water) ...	15	65–70
(3) Bleaching	5	65–70
(4) Washing (running water) ...	5	65–70
(5) Fixing	5	65–70
(6) Washing (running water) ...	20–30	

Development should be with constant agitation.

Steps 1–3 should be carried out in *total darkness*.

After bleaching is complete work may continue in normal room lighting.

The first wash should not be reduced in time to gain shorter processing, since, as development is still continuing, an under-developed image may result.

COLOUR DEVELOPER:

A	Distilled water	100	c.c.
	N-diethyl-p-phenylene-diamine sulphate	2.75	gm.

B	Distilled water	700	c.c.
	Ethylene-diamine-tetra-acetic acid (di-sodium salt)	2	gm.
	Potassium carbonate anhyd.	75	gm.
	Sodium sulphite anhyd.	2	gm.
	Potassium bromide	2.5	gm.
	Hydroxylamine hydrochloride ...	1.25	gm.

Add A to B with gentle stirring and make up to 1 litre with distilled water. Leave to stand for 12 hours before using.

BLEACH BATH:

Potassium phosphate		5.8	gm.
Sodium phosphate		4.25	gm.
Potassium ferricyanide		100	gm.
Distilled water	to	1	litre

FIXING BATH:

Sodium thiosulphate		200	gm.
Distilled water	to	1	litre

Paper Print Processing	*Time, Minutes.*	*Temp. °F.*
(1) Colour development...	3–5[1]	68 ($\pm\frac{1}{2}$° F.)
(2) Washing (running water)	10	60–70
(3) Stop bath	5	60–70
(4) Washing (running water)	5–15	
(5) Bleaching	5	
(6) Washing (running water)	5–10	
(7) Fixing	5	
(8) Washing	20–30	

Development should be with constant agitation.

Steps 1 and 2 should be carried out in *total darkness*.

After the print has been in the stop bath for 3 minutes, normal room lighting may be turned on.

The second wash (Step 4) is most important, for, unless all traces of the stop bath are removed intense red fog occurs during bleaching. To safeguard what might otherwise have been a good print, it is wise to snip off a small piece of the print rebate and place in the bleaching bath, and if after 1 minute no red fog develops it is then safe to continue processing.

COLOUR DEVELOPER:

A	Distilled water	100	c.c.
	N-ethyl-ethylhydroxy-p-phenylene-diamine sulphate	4.5	gm.
B	Distilled water	700	c.c.
	Ethylene-diamine-tetra-acetic acid ...	2	gm.
	Potassium carbonate anhyd.	78	gm.
	Sodium sulphite (cryst.)	0.5	gm.
	Potassium bromide	0.5	gm.
	Hydroxylamine hydrochloride ...	2	gm.

Add A to B with gentle stirring and make up to 1 litre with distilled water. Leave to stand for 12 hours before using.

STOP BATH:

Sodium phosphate	...	10	gm.
Potassium phosphate	...	10	gm.
Sodium thiosulphate	...	200	gm.
Distilled water ...	to	1	litre

BLEACH BATH:

Potassium ferricyanide ...	...	20	gm.
Distilled water	to	1	litre

FIXING BATH:

Sodium acetate ...	...	69	gm.
Potassium alum. ...	...	30	gm.
Sodium thiosulphate	...	80	gm.
Distilled water ...	to	1	litre

Colour Correction Filters

A most vital and necessary accessory is a set of colour correction filters which are used in the enlarger system for balancing the light source to the negative film,[2] the paper base[3] and for the correction of colour casts. A full description of this system is given in Dr. Berger's book[4] and is applicable in this case. Although the following table of equivalent filters are probably not identical with those of Agfa, Ansco Printon filters were used in practice and gave satistactory results.

Agfacolor	*Ansco Printon*	*Wratten*[5]
YELLOW SERIES:		
05 00 00	—	—
10 00 00	23	CC05Y
20 00 00	24	CC10Y
30 00 00	23 + 24	CC05Y + CC10Y
40 00 00	25	CC20Y
50 00 00	23 + 25	CC05Y + CC20Y
60 00 00	24 + 25	CC10Y + CC20Y
70 00 00	23 + 24 + 25	CC05Y + CC10Y + CC20Y
80 00 00	26	CC20Y + CC20Y
90 00 00	23 + 26	CC05Y + CC20Y + CC20Y
99 00 00	24 + 26	CC10Y + CC20Y + CC20Y
MAGENTA SERIES:		
00 05 00	—	—
00 10 00	33	CC05M
00 20 00	34	CC10M
00 30 00	33 + 34	CC05M + CC10M
00 40 00	35	CC20M
00 50 00	33 + 35	CC05M + CC20M
00 60 00	34 + 35	CC10M + CC20M
00 70 00	33 + 34 + 35	CC05M + CC10M + CC20M
00 80 00	36	CC20M + CC20M
00 90 00	33 + 36	CC05M + CC20M + CC20M
00 99 00	34 + 36	CC10M + CC20M + CC20M
CYAN SERIES:		
00 00 05	—	—
00 00 10	43	CC05C
00 00 20	44	CC10C
00 00 30	43 + 44	CC05C + CC10C
00 00 40	45	CC20C
00 00 50	43 + 45	CC05C + CC20C
00 00 60	44 + 45	CC10C + CC20C
00 00 70	43 + 44 + 45	CC05C + CC10C + CC20C
00 00 80	46	CC20C + CC20C
00 00 90	43 + 46	CC05C + CC20C + CC20C
00 00 99	44 + 46	CC10C + CC20C + CC20C

Mosaic Printing Filters

In the absence of the recommended mosaic printing filters,[6] the following method has been found satisfactory for arriving at the filter combination needed to eliminate colour casts in the test strip and for the final print:

View the test strip by daylight (preferably north light) to see the colour cast present. By inserting the appropriate correction filters into the line of vision the test strip may be brought into correct balance.

For making the final print (or another test strip if so desired) place in the enlarger the exact opposite of this combination.

Another method of arriving at the correction required is by selecting a filter of the same density and colour as the cast present, but this may prove difficult unless objects of a neutral colour (such as white) appear in the print.

The first method is to be preferred although more thought and care is required, but with practice this method becomes easy and reliable. One golden rule to remember is that *a colour cast is removed by a filter of the same hue.*[7]

It would be unwise to assume that the substitute processing and formulæ could give results equal to that of the official method, for in the first place, the colour reagents used cannot be obtained in a stabilised form, to the best of present knowledge. Consequently, there may be quite a large difference in the standard of these two important chemicals from batch to batch in manufacture, and under these circumstances it would be advisable to purchase the reagents in quantities of not less than 100 gm. (this amount being sufficient to process approximately 200 miniature films of 36 exposures and approximately 1,000 sheets of ¼-plate paper in each case). At this point it is felt that a word of warning regarding the toxicity of the colour reagents would not be out of place. Some people are extremely allergic to p-phenylene-diamine derivatives which are liable to cause severe dermatitis,[8] and for this reason it is advisable to wear rubber gloves during processing, or at the very least, to use forceps for removing the film or print from the colour developer. Every precaution should be taken when making up this developer, and on no account should the reagents be inhaled.

Secondly, the substitute colour correction filters are not exact equivalents, for the spectral transmission of the Agfacolor filters is not known, but in actual practice the Ansco Printon correction filters have proved quite satisfactory to eliminate even serious colour casts.

Lastly, but not least of all, the composition of the solutions may be similar to those of the official Agfa process, or on the other hand, they may be entirely different, and possibly over a period of time the colours may deteriorate because of this difference, but the test of time will tell. Agfa recommend the use of an anti-fading solution, which apparently contains formaldehyde and possibly ammonium carbonate to make the dyes more stable to light.[9]

Before concluding, the following notes may prove helpful to those intending to try their hand at processing:

ENLARGER.—It is necessary that the enlarger system be voltage controlled, or have some means whereby the intensity of the lamp output is stabilised, since it is well known that voltage fluctuations go hand in hand with variations of colour temperature, resulting in varying print density and colour balance.[10]

COLOUR DEVELOPER.—It is possible that the grade of colour reagent used may produce a solution of rather a dark shade, but this does not appear to affect the efficiency of the developer. Under suitable storage conditions—tightly filled and dark coloured stoppered bottles—the solution will keep for about 3 weeks unused. Care should be taken not to introduce air bubbles into this solution when pouring.

STOP AND FIXING BATHS.—It will be noted that the fixing bath has been buffered by the addition of potassium and sodium phosphate. It is possible that satisfactory results can be obtained without the addition of phosphates for simplicity, but on no account should acid be introduced, since this results in decolorisation of the dyes, and it is doubtful whether any means of regeneration is possible. Slight clouding of the fixing bath has no detrimental effect on processing, should this be noticed.[11]

BLEACH BATH.—This solution should be stored in dark coloured stoppered bottles. Exhaustion is indicated by failure of the yellow filter layer to be decolorised in 1 minute, and also by change of the normal yellow colour of the solution to one of green.[12]

UTENSILS.—After use it is advisable to thoroughly wash all dishes, forceps, thermometers, etc., for small quantities of stale solutions are not conducive to consistent results. Since contamination of one solution with another is not to be recommended, it is necessary to always keep one dish for one solution only.

The author would welcome the opportunity to enter into correspondence regarding problems arising from the disclosed method of substitute processing, should they occur, or to learn of any improvements which other enthusiasts may find or care to suggest.

To conclude this article without taking the opportunity of thanking Mr. C. L. Thomson, B.Sc., and Mr. D. H. O. John, F.R.I.C., B.Sc., would be most discourteous, for only with their many helpful suggestions and pointers has it been possible to arrive at the substitute formulæ so soon.

REFERENCES

(1) Berger, H., " Agfacolor " 1951, p. 103.
(2), (3) Berger, H., " Agfacolor " 1951, pp. 112–116.
(4) Berger, H., " Agfacolor " 1951, pp. 37–47.
(5) Kodak Data Sheet, CL-3.
(6) Berger, H., " Agfacolor " 1951, p. 40.
(7) Berger, H , " Agfacolor " 1951, p. 43.
(8) Bourne, " Photographic Dermatitis ", *Brit Journ. Almanac*, 1945, p. 82.
(9) Berger, H., " Agfacolor " 1951, p. 117.
(10) Berger, H., " Agfacolor " 1951, p. 87.
(11) Berger, H., " Agfacolor " 1951, p. 105.
(12) Berger, H. " Agfacolor " 1951, p. 104.

B.J., 1953, July 24, p. 384.

Developer Formulæ Incorporating Phenidone

Since its introduction commercially about two years ago Phenidone* (1-phenyl-3-pyrazolidone) has been successfully and advantageously used both in Britain and the United States as a replacement for metol in photographic developers. As Phenidone is now generally available in bulk packings ranging from ¼-oz. to 4-lb., it is felt that the publication of a number of formulae in which this new developing agent is used in combination with hydroquinone will be useful to those workers who wish to compound their own developers.

Phenidone-hydroquinone (PQ) developers which give no fog with low speed photographic materials can be prepared readily from Phenidone, hydroquinone, sulphite, carbonate, and bromide. For high speed negative materials which tend to run into fog, particularly with forced development, the addition of an organic antifogging agent is an advantage although this is unnecessary where the developer has been buffered to have a pH of less than 9 at working strength. The type of antifogging agent and the concentration employed is a matter of choice depending upon the type of material to be developed and the characteristics required. Benzotriazole, for example, is particularly useful for universal and contact paper developers, since it also has the effect of modifying the tone of the silver image so that this becomes the cold blue-black which is generally considered desirable with contact prints. With developers used for negative materials, other fog restrainers which do not influence the colour of the image can be employed. It should be remembered, however, that too liberal use of any antifogging agent can result in a slowing of development, a drop in speed and a loss in the maximum density of the silver image, so that additions should not exceed those recommended for a particular purpose by the suppliers.

Typical examples of PQ developers which can be recommended are as follows:

Universal developer for papers, plates and films (Ilford ID-62)

Sodium sulphite (anhydrous)	50 gm.
Hydroquinone	12 gm.
Sodium carbonate (anhydrous)	60 gm.
Phenidone...	0.5 gm.
Potassium bromide	2 gm.
Benzotriazole	0.2 gm. or 20 c.c. Ilford " IBT " Restrainer
Water ... ... to make	1 litre

This gives a stock solution which requires dilution before use.

For use with contact paper dilute 1 + 1 with water and develop for 45–60 seconds.

For use with enlarging papers dilute 1 + 3 and develop for 1½–2 minutes.

For dish development of plates and films dilute 1 + 3 and develop for 2–4 minutes.

For tank development dilute 1 + 7 and develop for 4–8 minutes.

Development temperature: 68° F.

Developer specially recommended for contact paper

Sodium sulphite (anhydrous)	50	gm.
Hydroquinone	12	gm.
Sodium carbonate (anhydrous)	60	gm.
Phenidone	0.5	gm.
Potassium bromide	0.25	gm.
Benzotriazole	0.2	gm. or
20 c.c. Ilford " IBT " Restrainer		
Water ... ... to make	1	litre

This gives a stock solution which requires diluting 1 + 1 with water before use.

Development time: 45–60 seconds at 68° F.

Developer for plates and films

Sodium sulphite (anhydrous)	75	gm.
Hydroquinone	8	gm.
Sodium carbonate (anhydrous)	37.5	gm.
Phenidone	0.25	gm.
Potassium bromide	2	gm.
Benzotriazole	0.15	gm.
or 15 c.c. Ilford " IBT " Restrainer		
Water ... ... to make	1	litre

This gives a stock solution which requires dilution with water before use.

Dilution: Dish strength 1 + 2. Development time: 2½–5 minutes at 68° F.

Tank strength 1 + 5. Development time: 5–10 minutes at 68° F.

This developer has characteristics approximating to those of Ilford ID-2.

Fine grain developer for plates and films

Sodium sulphite (anhydrous)	100	gm.
Hydroquinone	5	gm.
Borax	2	gm.
Boric acid	1	gm.
Potassium bromide	1	gm.
Phenidone	0.2	gm.
Water ... ... to make	1	litre at working strength

Development time: 7–11 minutes at 68° F.

This developer has characteristics approximating to those of Ilford ID-11, but shows less change in activity during use.

NOTE.—In preparing the above developers the chemicals should be dissolved in the order given. Solution should be effected in hot water (c. 120° F.).

B.J., 1954, Feb. 12, p. 82.

* The name " Phenidone " is a registered trade mark.

Increasing the speed of Ektachrome

Based on the outline given in the *British Journal of Photography* (June 19, 1953, p. 315) of the technique developed by the New York photolab of *Life*, which was described by J. R. Eyerman in the May, 1953, issue of *Popular Photography*, C. Hynds, of the Shell Photographic Unit, has worked out a practical procedure as follows:—

(1) *Post Fogging*. The exposed film was fogged for 10 seconds each side of the film to a Siemens 12-volt 48-watt lamp which had an opal glass and a Wratten green No. 61 filter in front of it. The aperture area was .125 sq. in. and the film 2 ft. away from it.

(2) *Prolonged First Development*. The film was developed for 20 minutes at 75° F. instead of the usual 10 minutes.

(3) *Hardening*. Normal 4 minutes at 75° F.

(4) *Washing*. Normal 5 minutes at 75° F.

(5) *Colour Developer*. Pre-soak in colour developer *before* reversal exposure (still in darkness) 7 minutes at 75° F.

(6) *Reversal Exposure*. Half-second both sides to normal reversal light-box for Ektachrome, 1 ft. away.

(7) *Colour Development*. Eight minutes at 75° F. (still in darkness) and then followed by normal processing procedure.

The result was acceptable at a taking film speed of 80 Weston.

No doubt modification would have to be made to different batches of film, perhaps only some after-treatment would be required, such as binding up the finished transparency with a colour-correction filter.

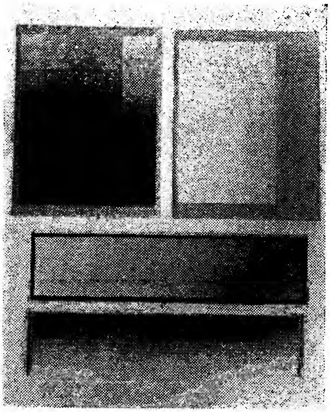
Finally the advice is given to keep the lighting flat and avoid dark shadows.

B.J., 1953, Oct. 30, p. 578.

Enlarging with Multigrade Paper: Contrast Selection and Exposure Determination Reduced to the Simplest Procedure

Clement Barnes has examined systematically the possibility of reducing the selection of contrast grade and determination of exposure in enlarging to a purely automatic procedure, using the minimum of test strips and the least possible judgment and calculation.

Variable contrast papers—Varigam (du Pont, U.S.A.) and Multigrade (Ilford Limited, England)—clearly provide a first step in this direction, but still call for judgment in deciding the requisite filter and exposure, while to change the filter means also changing exposure, so that several test strips may be needed, involving calculation and waste of time and paper. Working with Multigrade, the author has evolved several techniques, of varying degrees of convenience and simplicity. For the most complete technique an optical wedge was made, using Multigrade Contrast filter graduated from zero to maximum contrast over a length of six inches. It had been found that for equal highlight density maximum contrast required five times the exposure of minimum contrast. A neutral wedge of the same dimensions was therefore made graded from 0 to 0.7 density and bound up in opposition with the yellow wedge. It was found that enlargements made through the combined wedge placed in front of the enlarging lens varied continuously in contrast as the wedge was moved from one



end to the other in front of the lens, but all required, to a close approximation, the same exposure, so that adjustment of contrast needed no exposure correction, but only an endwise displacement of the filter.

To assist in determining the exposure in the first place without the need for the usual step-by-step test strip, another wedge was made, photographically—this time a step wedge, of the same dimensions as the compensated filter wedge but with the steps at right angles to the filter gradation. The two wedges, in contact, are placed on the enlarging easel over a test strip of Multigrade at a suitable part of the image and an exposure of, say, 30 seconds given, and the print developed for the standard time of 2 minutes in the usual developer at 68° F. The resulting print will be graduated from end to end in contrast and from side to side in density. That step is chosen which appears correct in both contrast and density, and reference to a step wedge calibration table which is easily made by experiment gives at once the correct exposure; the colour wedge is then slipped into its mount in front of the enlarging lens so that the same part of the wedge is in use as produced the correct step in the test strip (the wedge is edge-numbered for that purpose), and the final print is made with the exposure found. The compensated colour wedge and the step wedge are shown in the lower half of the illustration.

Since it is not practicable, in making the composite colour wedge, to compensate *exactly* throughout, in order that the exposure shall be precisely the same at all contrasts a further compensation is provided in the form of a variable resistance in series with the lamp. This is numbered corresponding to the wedge edge numbers, and with the resistance set to the same numbers as the wedge the exposure is identical for all contrasts. In practice however the residual error is small, and is always the same at any point of the wedge.

A further valuable use of the compensated wedge is that, once the approximate exposure has been found, a print can be made through the compensated yellow wedge (without the step wedge) placed direct on the Multigrade paper, and will show that portion ($6 \times 1\frac{1}{2}$ inches) of the picture correctly exposed throughout but varying in contrast from end to end over the entire contrast range of the paper. It is then very easy to pick out the optimum contrast, and set the filter at that number for the final print.

Various simplifications are suggested with the sacrifice of a certain amount of convenience. Thus instead of using a compensating neutral wedge the compensation can be carried out entirely by the series resistance. This gives uniform exposure for all contrasts but obviously precludes the use of the step wedge exposure determination technique described.

Another suggestion does not use a filter wedge but is based on the use of the standard Multigrade filters—Contrast, Medium, and Soft. This, of course, sacrifices the delicate contrast control of the wedge method, which is valuable since the best contrast often lies between those fixed by the filters, as it does between the grades of ordinary bromide paper. For this method a step wedge is bound up with three strips, one each of the three Multigrade filters, with one strip blank, each strip being compensated with strips of neutral density filter so that, as with the compensated filter wedge, the same exposure is required throughout all contrasts to give the same " highlight " step. This filter step wedge plate (top, left, in illustration) is then used in the same way, being placed on a sheet of Multigrade over a suitable part of the image on the enlarger easel, and a standard exposure given. The resulting print will be similar, except that the contrast will now vary in steps, instead of continuously. The best step is chosen, and the exposure read off from the calibration table. The final print is then made through the same grade filter as produced the chosen step.

For those who do not wish to do more than simplify the calculations necessary when trying out different filters to determine the best contrast, the author makes the simple suggestion that instead of using the Multigrade filters as supplied each one (except the Contrast filter) should be bound up, or used in conjunction with, a neutral density filter such that exposure will be the same for all, a further neutral filter being used for soft contrast requiring no yellow filter.

The author points out that the contrast of Multigrade can be extended further in the " soft " direction by using ID-3—plain metol—developer without any loss of colour or quality provided the print is developed for at least 3 minutes at 68°; further that results identical with those obtained with, say, D.163, but very slightly warmer, can be obtained with only 45 seconds development using the new Ilford Contrast FF developer—a considerable advantage for rapid working.

B.J., 1954, Feb. 19, 26, pp. 90-91, 102-104.

Faults in Glazing and Heat Drying

James L. A. Evatt has compiled the following useful analysis, in tabular form, of the many causes of defective glazing.

Fault	*Possible Causes*	*Cure*
Small imperfections and pittings in glaze.	(1) Grit in washing water.	(1) *a.* Fit water filter. *b.* Change filter bag.
	(2) Grit or dust on glazing surface.	(2) *a.* Clean rotary glazer as it revolves. *b.* Load glazing plate under water after washing.
	(3) Rotary glazer has become electrostatically charged and is attracting dust.	(3) Switch off and allow to discharge.
Many microscopic imperfections in glaze, no pitting, tendency to localisation.	(1) Glazer too hot.	(1) Cooler glazer.
	(2) Exhausted fixing bath.	(2) Fresh fixing bath.
	(3) Omission of stop bath.	(3) Use of stop bath.
	(4) Omission of *acid* hardening fixing bath.	(4) Use of *acid* hardening fixing bath, check with litmus paper.

Fault	*Possible Causes*	*Cure*
Many microscopic imperfections in glaze, no pitting, tendency to localisation.	(5) Plates or films fixed in same bath.	(5) *a.* Don't. *b.* Add boric acid to make a 1% soln.
	(6) Electrochemical reaction between glazing surface and washing water.	(6) No cure, see article.
Oyster shell ring marks on glazed prints.	(1) Glazing drum revolving too fast.	(1) Adjust rheostat.
	(2) Over hardened acid hardening fixing bath.	(2) Fresh fixing bath, less hardener.
Wavy edges of finished prints.	(1) Glazer too hot.*	(1) Adjust rheostat.
	(2) Insufficient pressure on print during glazing.*	(2) Adjust pressure o. cloth.
Poor overall glaze, inconsistent in quality, no flecks or pitting.	(1) Poor quality paper.	(1) Change make of paper.
	(2) Print retained too long on glazer when dry.	(2) Remove when glazing complete.
	(3) Grease on glazer.	(3) Wash glazer with soft soap, polish with good silver polish wash with 4% acetic acid.
Prints stick.	(1) Insufficient hardening in fixing bath.	(1) Add hardener.
	(2) Dirty glazer.	(2) As (3) above.
Brown stain on finished print.	OVERALL	
	(1) Forcing development.*	(1) Don't.
	(2) Omission of stop bath.*	(2) Use stop bath.
	(3) Exhausted fixing bath.*	(3) Fresh fixing bath.
	(4) Washing too long in chemically impure water.*	(4) No cure, see article.
	LOCAL	
	(1) Insufficiently deep developer.*	(1) Deeper developer.
	(2) Prints touching in fixing bath.*	(2) Individual attention for first 15-20 secs. in fixing bath.
	(3) Prints rise to surface of fixing bath.*	(3) Fix prints face downwards.
	(4) Dirty cloth on glazer.	(4) Change cloth.
Brownish purple stain on finished print.	(1) Exhausted fixing bath.*	(1) Fresh fixing bath.
	(2) As (2) and (3) above.*	(2) As (2) and (3) above.

Prints other than glossy, when heat-dried may show defects marked * above, and in addition

Wavy edges to finished print.	(1) Insufficiently dried at too low a temperature.	Adjust speed and/or rheostat of rotary drier accordingly.
	(2) Dried too quickly at too high a temperature.	Adjust time of drying with flat bed drier to 10-15 minutes.
Fluff from cloth adhering to finished print.	(1) Drier too hot.	(1) Adjust rheostat.
	(2) Pressure of cloth too great.	(2) Adjust pressure.
Pattern of cloth on finished print.	Pressure of cloth too great.	Adjust cloth, check for shrinkage, check rotary drier squeegee released.
Loss of glass, general dullness or may be localised.	(1) Drier too hot.	(1) Adjust rheostat.
	(2) Exhausted fixing bath.	(2) Fresh fixing bath.
	(3) Plates and/or films fixed in same bath.	(3) *a.* Don't. *b.* Add boric acid to 1%.
	(4) Insufficient hardening.	(4) Adequate hardening.

B.J., 1953, Jan. 23, p. 47.

Fluorescence Photography in Colour

F. Mandel describes a technique which has been adopted for the particular application of the photographic recording in colour of the fluorescence of paper chromatographs; the method should however be equally suitable for subjects exhibiting similar fluorescence.

(1) *Sources of ultra-violet light*

Of available sources—carbon arc and gaseous discharge lamps—the latter has been found the most convenient, and of these the mercury vapour type is the most suitable.

(2) *Filter over the source*

A filter is needed over the source to prevent visible light from reaching the subject. A filter sufficiently dense to absorb *all* the visible light also reduces the intensity of the ultra-violet radiation to the point where exposures of 20 minutes with Ektachrome are not uncommon. A compromise is therefore called for, and eventually the best combination of lamp and filter was found to be the Osram type MBW/B, which is a mercury vapour source of 150 watts, enclosed in a glass envelope consisting of a Wood's glass filter. The maximum transmission is at 3650 A, and although when examined through the spectroscope the lamp transmits bands in the visible violet, blue, green, and red, their relative brightness is insufficient to impair the ultimate correct colour rendering of the fluorescence.

(3) *Filter over the Camera Lens*

As it is required to record only the visible fluorescence a Wratten filter number 2A (recently revised and now called 2B) is placed over the lens to absorb the unwanted ultra-violet radiation reflected and scattered by the subject in the direction of the camera lens. The filter absorbs wavelengths shorter than 4100 A, and is absolutely essential in order to avoid a deep blue over-all cast on the film.

The following is a description of the method used by the author for the recording of paper chromatography on Ektachrome film. The subject is pinned up on the copying board and two MBW/B lamps each at 45 degs., and in reflectors, are placed at a distance of 12 in. This may seem very close, but as the subject is only about 6 in. across, even illumination is obtained. With larger subjects, of course, the lamps have to be moved further away. A 6-in. lens is used, stopped down to *f*/4, and with the camera extension at 10 in. the correct exposure time is 2 mins. on Ektachrome film. To compensate for the comparatively long exposure time for colour film, colour correcting filters are used, namely, the Wratten CC 25 and CC 35 together.

B.J., 1953, Aug. 7, p. 407.

Making Composite Slides of Coloured Maps and Diagrams

Black as a colour in line work such as maps and diagrams is always a photographic problem, since it will appear on every negative.

Most simple maps and diagrams consist of black and two colours. When a sheet measuring 20 in. × 30 in., and some times larger, is reduced down to an equivalent rectangle on a 3¼-in. × 3¼-in. lantern plate, the resolution of fine detail which is apparent in the original is inclined to suffer if produced on colour material.

The author, John F. Wilton, had not found it possible to produce a straight colour transparency of the common case of a simple diagrammatic map in black, and blue, and varying shades of yellow, to compare with a composite slide produced by the following method.

Three negatives are first produced accurately matched for size so that they will register and of the correct dimensions for printing on to lantern plates. No. 1 has black with yellow, the blue has been filtered out. No. 2 has black with blue, the yellow has been filtered out. No. 3 has black only, both yellow and blue have been removed by some filtering, slight excess exposure, and, rarely, some stopping out by hand painting.

This black-only negative is most important, being the key to the problem; the better it is, the easier the procedure.

From this negative a very slightly unsharp, and in some cases not unsharp but only well exposed, mask is made by contact methods, and fully developed. When the mask is dry it is registered with negative No. 1 (black and yellow), in which it blots out all black. This sandwich is secured in register with sticky tape, and is projected through an enlarger on to an unexposed lantern plate, producing a positive of the yellow areas only.

This positive must be laterally reversed when compared with a normal positive which would be made from its negative and so the latter can either be turned over in the enlarger so that it prints as a lateral reversal, or can be printed right way up and a lateral reversal produced by chemical reversal methods. The point of lateral reversal of this positive will be obvious as we proceed.

Similar methods are used to produce a positive of No. 2 (blue) negative, only in this case no reversal is needed and the positive must be made on the thinnest film available in the " process " range.

We now have one laterally reversed positive of the yellow areas on a lantern plate, one positive on thin film of the blue areas. All that is needed is a contact positive from the black negative No. 3. This contact positive should be made first, but has not been mentioned until now, for greater clarity of explanation.

This black only positive is the key for size, and both the laterally reversed positive and the positive on film are brought to register for size with it on the enlarger table. It must be remembered, when making the blue positive on film, that the film must have an equal thickness under it, when printed, as the black positive on glass, or variation of size will occur.

Here it should be noted that if two glass positives are to be finally bound together in register one of them must be laterally reversed. Otherwise the film will be outside collecting all the thumb prints from the projectionists, and out of register by the thickness of glass.

The blue and yellow positives are dyed to the colours required by one of the proprietary methods and the metallic silver removed. This could also be done by any of the known methods published in the " B.J. Almanac " if the colours are suitable.

Finally, all three positives are assembled in register over a light table, clipped together and any spare film cut off. They are bound, spotted, and titled, and will project in the lantern as a bright, sharp image in black and two colours.

Film up to .008 in. has been used for the blue positive without any apparent lack of register on the screen.

B.J., 1953, May 22, p. 267.

A Compact Ring-Illuminator Equipment

Stanley W. Bowler has devised an extremely neat " ring " illuminator for the high intensity lighting of a 3-inch diameter field for photomacrography. It is constructed mainly from two household kitchen utensils and Perspex sheet, and the light source is a ring of eight 24-volt 6-watt G.E.C. Group II festoon bulbs in series with a short-circuitable 150-ohm resistance (fig. 1). Thus with the resistance in circuit, on a 220-230-volt supply, 48 watts of illumination are concentrated by the trough reflector on to the 3-inch field, with an intensity which is greatly increased when the resistance is short-circuited by a switch in the handle.

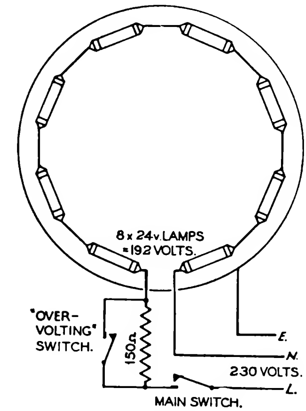


Fig. 1.

The body components, seen in section in fig. 2 (top), are an annular cake baking tin, of light gauge spun aluminium, used for baking cakes with a hole in the centre, which forms the reflector, and a pudding basin, of rather heavier gauge, chosen to fit over the outside rim of the trough, forming the outer casing which carries the camera and the handle. The inner wall of the trough is cut away as shown sufficiently to allow each lamp to illuminate the whole field while still shielding the lens. The two are fitted together and secured by screws which at the same time secure the shaped Perspex partitions which support the lamps. Each of these partitions has a hole drilled through it into which is " screwed " a short spiral spring, and it is between these springs that the bulbs are resiliently held, with a continuous electrical circuit throughout, broken only at one point (fig. 2, top partition, lower diagram) where the simple partition is replaced by a triple Perspex partition with two separate springs insulated by the central sheet and copper foil electrodes sandwiched between the Perspex layers taking the current from the

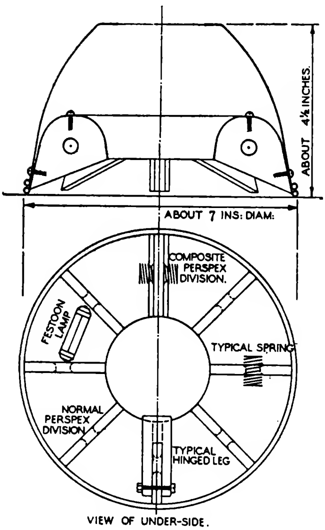


Fig. 2.

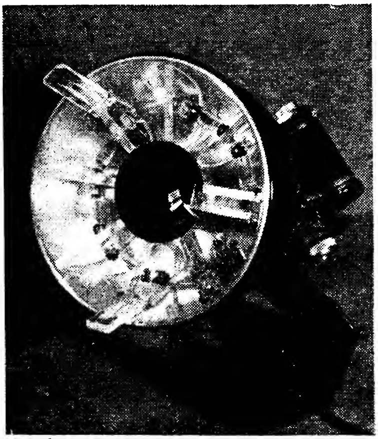


Fig. 3.

outside leads. The resistance may be housed either between the two aluminium spinnings or inside a hollow handle (the one shown is a hollow bakelite ex-Government surplus handle ready provided with two switches). It is desirable that both switches should be of the " hold-on " type, to ensure that the unit is not left alight so that it overheats, or the resistance left out of circuit, thus shortening the life of the lamps.

The camera—in the author's case a Rectaflex single-lens reflex miniature, used with two fixed extension tubes giving a ratio of 1.66: 1, and a field area of $1\frac{1}{2} \times 2\frac{3}{8}$ ins., with a 5-cm. Angenieux *f*/1.8 lens—is mounted on the top of the basin, in which a 2-$2\frac{1}{2}$-in. hole is cut. With this equipment, using Ilford FP3 film processed in a fine-grain developer, exposures of 1/25 sec. at *f*/11 give good results with the lamps " over-volted ". The folding legs seen in figs. 3 and 4 are cut from Perspex sheet and pivoted on a bolt through the outer edge of the respective separators ; these hold the illuminator at a fixed distance from flat copy, and fold inwards when not in use.

B.J., 1953, April 10, pp. 185-7.

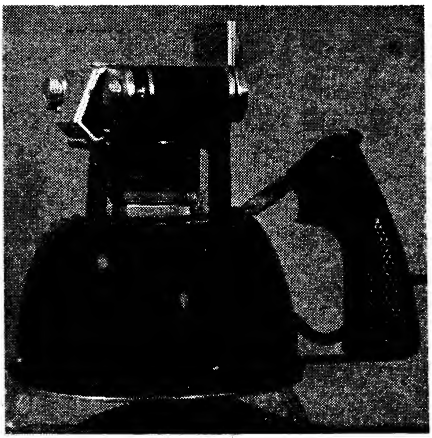


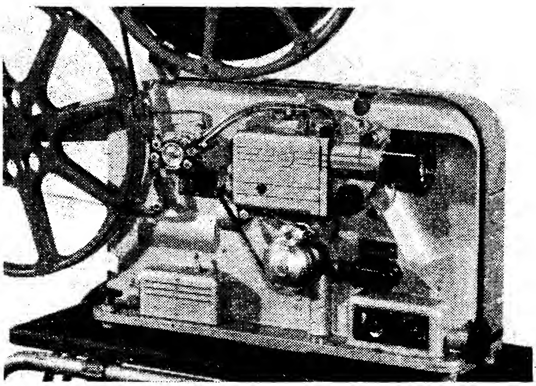
Fig. 4.

All the apparatus and materials reviewed in this section have been examined or used by the editorial staff of the "British Journal Photographic Almanac." In many cases, they have been tested both in the laboratory and in practice. This does not mean that the publishers can accept any responsibility for the quality of either materials or workmanship of any of the goods included in this section but the descriptions and test results are the outcome of personal experience and are not simply based on manufacturers' literature.

TYPE 401 16-mm. SOUND FILM PROJECTOR

The British Thomson-Houston Co. Ltd., Crown House, Aldwych, London, W.C.2)

This new projector, whilst similar in outward appearance to its predecessor, the Type 301, incorporates a number of changes in design which contribute greatly to its efficiency and portability. Perhaps the most notable feature of the new model is the reduction in mechanical noise which has been achieved; a sound absorbing case is no longer fitted and even without this the projector is quieter than was the former model with its case. The factors which contribute to this quieter running are several; the gear drive to the picture head has been replaced by a rubber belt drive, the cam which produces the intermittent motion of the pull-down claw has been redesigned so that on entering and leaving the film the click produced by the claw is much reduced, and finally, a fabric gear has been introduced into the drive of the intermittent.



By virtue of the single sprocket design the projector is extremely easy to thread and the lens mount swings well clear of the gate when the latter is opened for threading. The upper film path is fixed by two highly polished guide rods between which the film runs on its travel from the sprocket to the top of the gate. The two spool arms, which for carrying can be folded to nest in the body of the projector, are sufficiently large to accept 2,000-foot spools. The drive to the spools is totally enclosed and a power rewind is fitted.

An important feature of the sound reproducing system which was fitted to the 301 and which has been retained in the newer model is the refocusing device for the sound optics. This enables the scanning beam to be correctly focussed for either a normal positive printed from a negative or a reversal positive such as a Kodachrome print.

The sound quality of the new model is really excellent and the maximum output of the amplifier is now 30 watts. This large increase in available power has been attained by the use of much larger output valves—two EL37—in push-pull. The total distortion at maximum output is 5 per cent and at 10 watts this becomes only 1 per cent.

Two different speaker units are available to suit the conditions under which the projector will be used. The smaller unit consists of a 12-in. unit which is mounted in a ported baffle with a closed back and is capable of handling up to about 10 watts. If it is desired to use the full 30-watt output which the amplifier is capable of delivering, and a more permanent installation or a large hall is to be used, then a twin speaker unit is available. The appearance of this unit is most attractive, and the sound it delivers even when fully loaded is clean and crisp.

The other important point when a large audience has to be satisfied is the brightness of the picture. Here again the redesign of the projector has increased the amount of available light considerably. The projector is fitted with a 115-volt 750-watt lamp and with the coated 2-in. *f*/1.5 Dallmeyer projection lens a total light flux of over 300 lumens is obtained.

The B.T.H. 401 is finished in a most attractive silvery blue hammered lacquer which is extremely tough, and the finish and workmanship of all the moving parts is in every way excellent. This new machine can be confidently recommended to all who need a projector which is capable of giving a picture and sound of the highest professional standard. The price is £235.

1200 ELECTRONIC FLASH EQUIPMENT

(Langham Photographic Instruments Ltd., 132 Stanley Park Rd., Carshalton, Surrey)

One of the prime disadvantages of studio electronic flash has been the difficulty of assessing the arrangement of the lighting units before the exposure is made. It is, of course, possible to improvise some sort of pilot light in each reflector, but it is difficult to arrange that the source of this lighting and the flash tube give exactly the same lighting angle. This problem has been surmounted by including a small tungsten filament lamp within the glass protective cover of the flash tube, but so far as we know the Langham 1200 is the first outfit in which the light output of this effect lamp has been directly related in constant fashion to the light output of the flash tube when this is varied.

The total output of the 1200 is, as the name suggests, 1,200 joules, and this can be divided among up to five flash tubes in a number of different combinations by switching on the panel of the power unit.

The possible combinations are:—

1 × 400 joules and 4 × 200 joules; or
2 × 400 joules and 2 × 200 joules; or
3 × 400 joules.

Thus the loading of each tube can be switched from 200 joules to 400 or vice versa at will. When this change is made from the appropriate switch on the panel the brightness of the tungsten pilot lamp is also altered in intensity in the correct proportion. This leads to a further useful aid in that the correct exposure and the relative balance of the various units may be calculated by means of an incident light exposure meter in just the same way as is done with normal flood and spotlighting.

For exposure assessment the flash factor system need not be used, all that is required is an initial calibration test with the exposure meter and one or two films of the type it is intended to use. If, for example, tests showed that on a given material the exposure meter reading from the pilot light was 25 foot candles and the correct exposure to give a good negative was at a stop of f/8, then on subsequent occasions if the reading was 50 or 12 foot candles the stop for correct exposure would be f/11 or f/5.6 respectively.

As already described, up to five tubes may be used with the unit and these are mounted in large diameter matt finished reflectors mounted on well-finished studio stands which are readily adjustable for height. A boom stand can also be used if desired to provide top lighting.

The power unit stands some three feet high and is mounted on rubber-tyred castors so that it can be easily moved in the studio. The outer casing is of heavy gauge metal sheet finished in black wrinkle enamel. Internally the power unit conforms to the high standard we have come to expect from Langham equipment.

The leads to the flash heads are all taken from a panel at the back of the power pack and all the plugs are covered by a hinged metal panel. When this cover is unlocked and lifted the main supply to the unit is automatically switched off and a bleeder resistance absorbs the energy which has built up in the capacitors. The equipment can not be operated until the cover has again been firmly secured.

It will be realised from this description that the Langham 1200 is a well thought out piece of equipment with enough output and flexibility to make it entirely suitable for professional, commercial, industrial, advertising, and portrait studios. It is eminently suited for the studio using colour materials, but will equally enable fine work in black and white to be accomplished with the minimum of difficulty and the maximum of economy. The price, including three flash heads one on the boom fitting, is £350.

P.Q. UNIVERSAL DEVELOPER

(Ilford Ltd., Ilford, London)

This new universal solution is one of a range of developers now being supplied by Ilford, containing Phenidone in place of metol. One of the advantages of this new Ilford developing agent is that a highly concentrated Phenidone-hydroquinone developer may be made without the use of caustic alkali such as is generally used with concentrated methol-hydroquinone solutions. Hence this new universal solution contains no caustic alkali whilst at the same time having all the advantages of high concentration.

For films and plates developed in a dish the recommended dilution is 1+9 and with this dilution the recommended development time for HP3 roll-film is 4¾ mins., and for HPS plates 6 mins. For tank use the dilution is 1+19, and the development times are twice as long as those given above.

For contact papers the dilution is 1+4 and the development time 45 to 60 secs., and for enlarging papers 1+9 with a development time of 1½ to 2 mins. All these times are for a temperature of 68 degs. F.

When tested with film and plates the recommended times gave excellent negatives, clean and of good quality. With contact and enlarging papers P.Q. Universal gives a good neutral black image. The developer is available in 8 oz., 20 oz., and 80 oz. packings at prices of 2s. 9d., 4s. 6d., and 11s. 6d. respectively.

MOVIKON 8 CINE CAMERA

(Peeling and Komlosy, 181 Victoria Street, Dunstable, Bedfordshire)

The radical re-styling of a standard 8-mm. movie camera which is evident from the illustration of the Movikon 8 has been made possible by arranging the feed and take-up spools side by side within the camera with their axes parallel to the lens axis. In the exact centre of the camera, between the spools, is placed the gate, and the film is fed from the left-hand spool (with the camera held in the operating position) at the bottom, through the gate and on to the take-up spool on the right at the top. Thus the loops on either side of the gate are staggered or " drunken " loops.

This unusual layout brings with it a number of useful features. The shutter is of the sector type which, although universal in 35-mm. motion-picture cameras, is generally not used in 8-mm. cameras for reasons of space. The actual shutter opening is 201 deg. which is a high ratio of open time/closed time giving a high light efficiency.

The camera is easy and quick to load, in spite of its somewhat unorthodox film path. The gate opens through 90 degrees and threading is thus facilitated; a light spring edge-guides the film and gives a high degree of horizontal steadiness to the picture. A circular aperture with a retractable cover is provided in the gate itself. With the back of the camera removed and the cover open the camera may be focussed on the film for close-up work, though not with normal reversal stock in the gate, for obvious reasons.

The lens is a 10-mm. f/1.9 Movitar fitted in a focussing mount which covers down to 8 inches. It gives pictures of as good definition as we have seen and this wide range of focussing movement will undoubtedly be of great advantage.

In use the camera is held in precisely the same way as a miniature camera, and the release button falls to the right forefinger in the accepted fashion. A similar button on the opposite side of the camera body is turned to set the camera for single picture or continuous running. A cable-release socket is also provided on the left of the viewfinder.

The finder is the conventional direct vision optical pattern with two sets of index marks for parallax correction at 1 ft. 6 in. and 1 ft. The eyepiece side of the finder is sensibly black, not chrome, and no difficulty was experienced in using the camera whilst wearing spectacles. The footage counter, which is of the impulse type, is clear and easy to read.

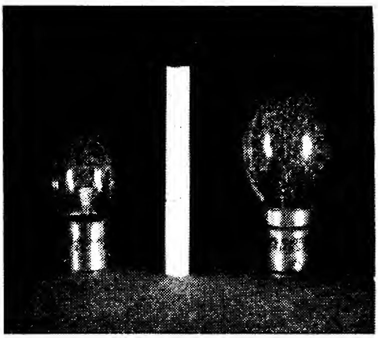
The camera runs extremely sweetly and almost noiselessly and will run for about 25 seconds on one winding. The motor is not of the positive stop type. The front plate of the Movikon 8 is finished in matt chrome and the remainder of the body in brown wrinkle enamel.

To sum up, the camera is one of the most beautifully designed and finished we have ever handled and it is a worthy addition to the range of narrow-gauge cine equipment produced by Zeiss-Ikon. The price is £49 17s. 6d. plus £16 4s. 2d. purchase tax.

PHOTOFLUX LAMP TYPE P.F.3

(Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2)

Like the P.F.14, with which it is shown in the illustration for size comparison, the P.F.3 is an M-class bulb which may be used with shutters having X-type synchronisation at a shutter speed of 1/25 sec. or at any shutter speed in an interlens shutter which can provide M synchronisation. The time interval between contact and peak light output is 20 milliseconds, and the total light output in lumen-seconds is 5,500 as against 10,000 for the P.F.14. The maximum luminous flux of the P.F.3 is 0.5 million lumens compared with 0.8 million lumens for the P.F.14. Thus it will be seen that in spite of its small size the P.F.3 produces a considerable amount of light. In fact, tests show that the recommended guide number of 130 for a fast panchromatic film with 1/25 or open flash gives a perfectly acceptable negative.

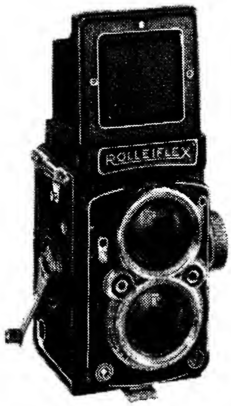


The bulbs are packed two to a cardboard tube which measures just $\frac{7}{8} \times \frac{7}{8} \times 4\frac{1}{2}$-in., and half a dozen in their packets can be easily slipped into a normal jacket pocket. The price of the P.F.3 is 10d.

ROLLEIFLEX 2.8C

(R. F. Hunter Ltd., Celfix House, 51 Gray's Inn Road, London, W.C.1)

In appearance the Rolleiflex 2.8C resembles the standard Rolleiflex Automat but the increased size of the front element of the f2.8 Xenar is immediately obvious. The iris and shutter-setting discs are now provided with locks which prevent either the aperture or shutter-speed being accidentally altered by the setting dials being turned by chance contact. The locks take the form of a raised rib beside the setting disc which must be gently pressed in-. wards before the disc is turned. The shutter release is also provided with a lock in the form of a quarter-circle moulding which rotates through 90 deg. with the shutter-release button as centre. An identical fitting is provided on the flash socket on the opposite side of the bottom of the lens panel where it performs the function of locking the flash lead in place. The delay setting (either X or M) for the Synchro-Compur shutter is at the top of the lens panel and takes the form of a small lever which can be swung through 180 deg.; a similar lever on the opposite side of the panel controls the delayed-action setting.



The focussing knob is now of larger diameter and incorporates a reminder device which can be set to indicate the film type and speed with which the camera is loaded. A depth-of-field scale is provided on the index plate.

The left-hand (with the camera in the operating position) film-spool pivot is now combined with an exposure counter for 35-mm. film so that the Rolleikin back no longer contains this component. The film-wind crank mechanism has also been remodelled so that double exposures may be made if required; the shutter may be set without winding on the film by releasing a catch beneath the hub of the crank and turning the crank backwards.

The focussing hood incorporates the usual magnifier, but this is now adjustable for distance from the focussing screen to suit the eyesight of the photographer. The hood also incorporates a mirror which can be swung into position so that the camera may be used at eye level and still be focussed on the screen. The magnifier at this position is also adjustable, but does not enable the whole of the screen to be seen by virtue of its somewhat higher magnification compared to the top screen magnifier. When the 45-deg. mirror is in position the front portion of the focussing hood forms a frame finder.

Internally the camera closely resembles the Rolleiflex Automat; the camera back is removable and carries a two-position pressure plate for 6 × 6-cm. and 24 × 36-mm. The back is also completely removable for the substitution of a plate back. The film-wind mechanism is also unchanged; the film is threaded through the two feeler rollers which operate the automatic-wind mechanism as soon as the extra thickness of the film and the adhesive strip by which it is attached to the backing paper pass through. The exposure counting mechanism is operated by the usual milled-edge wheel which presses on the backing paper as it takes up on the top spool.

Perhaps the most noticeable feature internally is the provision of deep baffles in the body.

The f/2.8 Xenotar lens gives negatives of good definition and from the whole negative enlarged prints 30×30-ins. can be made with adequate sharpness over the whole picture. The finder lens, also an f/2.8 lens, gives a screen image which is excellently bright right out to the corners of the field. In all, this new Rolleiflex model is a worthy successor to the range of models already available; it is every bit as beautifully finished and cleverly designed as its predecessors.

PACTUM NEGATIVE AND PRINT STOP BATHS

(Johnsons of Hendon, Hendon Way, London, N.W.4)

These two new additions to the range of packed chemicals made by Johnsons each make 20 ozs. of solution. The negative stop bath is of the chrome alum type and thus serves the double duty of arresting development and hardening the emulsion. This latter property alone makes the use of such a solution between development and fixing advisable since it will greatly reduce the likelihood of reticulation should the temperature of the wash water be widely different from that of the solutions. It can also be used to harden negatives which have already been processed and dried, should this be necessary. The treatment time in all cases is 5 min.

The print stop bath is a solution which ought always to be used since, in addition to stopping the development at once, it will prevent the carry over of alkaline developer, prevent stains and conserve the life of the fixing bath.

As one would expect, tests showed that both solutions do their work well and they keep well in a closed container. The end of the useful life of the negative stop bath can easily be determined by the colour change which always takes place with chrome alum solutions. The price of these useful Pactums is 7½d. each.

FLORIJO CINE TRIPOD

(Ilford Ltd., Ilford, London)

This tripod is of conventional form for a lightweight tripod suitable for narrow-gauge cinematography, but contains one or two novel features in its design and construction. The legs of the tripod comprise three sections each and when fully extended these give a height of 4 ft. 9½ in. The legs are locked in position with a half-turn clockwise and unlocked with a half-turn anti-clockwise. The lock operates positively at any position between fully extended and fully retracted. The height of the tripod in the latter case is 2 ft.

The two upper-leg sections are made from steel tube and the lower section of brass. All sections are thin-walled and each is an accurate sliding fit.

An adjustable chain is fitted to the three upper-leg sections to prevent them spreading beyond a fixed amount. The tripod head, to which is permanently attached a pan-and-tilt head, is an alloy casting, and the trunnions into which the legs are fitted are of large size. The pan movement of the head is locked by a small thumb-screw at the side of the top platform and the tilt is locked by twisting the pan arm in the customary fashion. The pan arm is 9-in. long and instead of projecting horizontally from the head when the tripod is levelled, as is usual, it makes an upward angle of about 25 degs. with the horizontal. When not in use the pan arm can be screwed into a threaded bush on the underside of the head between the legs of the tripod. A blanking screw is provided to prevent access of grit to the tilt bearing when the handle is not in place.

The camera-holding screw is provided with a large diameter milled head and is captive in the top plate. The pan-and-tilt head is finished in black crackle with the top plate which bears against the camera polished.

When the tripod is fully extended it would seem to be adequately rigid for narrow-gauge cameras and there is no doubt that the chain which is fitted is of assistance in this respect. The price of the Florijo Cine tripod is £12 0s. 0d., plus £3 18*s*. 0d. purchase tax.

PHOTOTRONIC SLAVE FLASH UNIT

(Langham Photographic Instruments Ltd., 132 Stanley Park Road, Carshalton Surrey)

Firing supplementary flashbulbs or extension electronic units is always a problem to the working photographer, especially if the run of connecting cables amounts to any great length.

The elegant solution to these difficulties is to fire individual units electronically by the use of a photocell which operates a relay working as a switch in the flash circuit. This, in turn, brings more difficulties; a general increase of the prevailing lighting, extra lamps switched on nearby, the sun coming from behind a cloud, would in all probability fire the bulbs in the extension just as easily as would the main flash.

This new Langham unit contrives to solve these problems in a most satisfactory fashion and give the maximum utility of such a light-operated device without the risks and snags of circuitry of the more obvious type.

The key to the operating of the unit is the fact that it will only respond to light *pulses:* that is it is capable of discriminating between the light from a flash unit—which should operate it, and variations in the general lighting—which should not.

The outward form of the instrument conforms to the general styling of the Langham electronic flash units, being a steel outer case with rounded top edges. In size, of course, it is rather smaller than a flash unit, actually $4\frac{3}{4} \times 4\frac{3}{4} \times 3$-in. The case is finished in fine black crackle enamel and the control panel in satin chrome. A standard shoe fitting is provided on the top so that a flash head or battery flash-gun may be fitted, and a tripod bush is fitted in the base-plate so that the complete outfit may be placed on a tripod in a suitable position.

Up to three flash units of the same type, that is either all electronic outfits with the same voltage across their synchronising outlets or three capacitor or straightforward flashguns with similar characteristics, may be connected to the three pairs of synchronising sockets. The plugs needed for these sockets are of a standard pattern and easily obtainable, which is a useful point. The power supply for the unit consists of five 30-volt hearing-aid batteries and the drain is so small that the life of the batteries is effectively their shelf life, indeed, it is claimed that with normal use their working life may exceed the manufacturer's rated shelf life.

The price of this most useful accessory flash unit is £16 15s. 6d., and we would think that its virtues would rapidly commend it to many photographers whose work involves the multiple firing of flashbulbs in whatever field they work.

ENVOY JUNIOR ENLARGER

(Photo Developments Ltd., Leonard Road, Handsworth, Birmingham 10. Marketed by Ilford Limited, Ilford, London)

This new enlarger contains a number of rather original features in its design, and some of its parts are made from unusual materials. Basically the Envoy Junior is a perfectly conventional instrument for negative sizes up to $2\frac{1}{4} \times 3\frac{1}{4}$-in. and is supported on a plywood baseboard some 17×15-in. in size. The flange which supports the column on the base board does not surround the column in the conventional fashion, but is only a half tube. The column is secured to this by a large size bolt fitted with a wing nut.

The column is a 30-in. length of extruded aluminium tube $1\frac{3}{4}$-in. in diameter, and finished by anodising.

The basis of the enlarger head itself is a light alloy casting which forms the bottom of the lamphouse and the negative carrier. This unit is supported from the column by a cast alloy bracket. The lens panel is carried by two parallel rods, but in contrast to the usual system whereby the lens panel slides up and down the rods, the panel in this case is firmly fixed to their lower ends. The two rods then slide in and out of the main head casting and project into the lamphouse. This method gives a larger bearing surface at the point at which the sliding motion takes place, and also enables a very novel focussing movement to be used.

Fixed at one end of one of the rods with a tension adjustment is a thin steel stranded wire. This wire runs down the rod and is fixed at the lower end to the lens panel. At right angles to the two support rods within the head casting is a shaft which carries on its right-hand outer end a large knob. The portion of this shaft which is within the lamphouse carries a fairly coarse thread, and one turn of the wire which runs down the support rod is taken round this shaft and grips in the turn of the thread. Thus when the knob at the end of the shaft is turned the lens panel is moved up and down smoothly and quite without any backlash. This is quite the best and simplest focussing movement we have encountered on an enlarger of this pattern.

The bellows are circular in section and are moulded from black rubber. The negative carrier, too, is a rubber moulding, and the design is such that the weight of the upper glass may be taken off the negatives in order to move the strip along. The film cradles are made from blue flexible polythene.

The enlarger is supplied with a flashed opal diffuser, and if desired condensers can be obtained for 35-mm., $2\frac{1}{4}$-in. sq. and $2\frac{1}{4} \times 3\frac{1}{4}$-in. negative sizes. The head casting is so made internally that the two condensers which are used for the largest size negatives are simply fitted into suitable lugs which are cast internally. For the two smaller sizes of negative, adapter plates are used to support the smaller size condensers.

The lamphouse is a light metal spinning which is finished, like the head casting, the bracket, the column flange, and the lens panel, in blue hammer lacquer.

The enlarger is pleasant and comfortable to use, the focussing action being particularly good.

The price of the basic enlarger, without lens or condensers is £10 10s. 0d. plus £3 8s. 3d. purchase tax. The pair of condensers for $2\frac{1}{4} \times 3\frac{1}{4}$-in. negatives cost £2 14s. 0d., the set of condensers and an adapter plate for $2\frac{1}{4}$-in. sq. negatives cost £3 12s. 6d., and the condenser and adapter plate for 35-mm. cost £1 13s. 6d. Panels can be obtained for a wide range of lenses from manufacturers such as Dallmeyer, Taylor, Taylor & Hobson, Ross, and Wray.

DEVELOPER 468

(Johnsons of Hendon Ltd., Hendon Way, London, N.W.4)

This new developer, which is packed in the form of a powder, is basically a metol-hydroquinone formula which contains in addition to the usual constituents Johnsons developer improver 142 and wetting agent 326. The formula of the developer has been specially compounded to produce an intense blue-black tone on all types of contact and document papers although it is equally suitable for the development of bromide papers of all types. Developer 468 can also be used for the development of films and plates and the development times when used for this purpose are perfectly normal and comparable with those which obtain with any other recommended developer of similar type.

The powders are dissolved to form a stock solution which is diluted 1 to 1 for contact papers and document papers and 1 to 3 for bromide and chlorobromide papers. When used for films and plates the recommended dilutions are 1 to 4 for dish development and 1 to 10 or 1 to 15 for tank use. Complete time and temperature tables for negative development are given in the instructions packed with the developer and these are applicable to a wide range of different sensitive materials which are listed.

The developer is available in a range of packings to suit all users; the smallest size, which makes 20 oz. of stock solution, costs 2s. 9d. The next larger size, 80 oz. stock solution, costs 5s. 3d.; 1 gal. stock solution 9s. 6d.; 2 gal. stock solution 17s. 3d.; 5 gal. stock solution 39s.; and the largest size which makes 10 gal. of stock solution, 72s.

SOUPLINOX DEVELOPING TANK

(Photax (London) Ltd., 70 Charlotte Street, London, W.1)

The Souplinox is a developing tank of the apron type in which the film is wound on to the reel which holds it during the development process interleaved with a plastic strip. The plastic strip or apron has a series of small dimples moulded into its outer edges so that the emulsion surface of the film makes contact with it only at these edges outside the picture area.

By interchange of the apron the tank can be used for a range of film sizes from five feet of 16-mm. up to 116 roll films. The upper cheek of the reel is held in its proper position on the centre column for the film size in use by a stainless steel spring which engages with any one of a series of slots which runs the length of the column.

A separate agitator is provided and the top of the tank is moulded so that it forms a funnel for easy filling with the solutions. A separate outlet is provided of generous size and the tank can be emptied reasonably rapidly. The top of the tank locks in place with a slight clockwise turn. An interesting innovation on the instruction sheet is the formula for a fine-grain developer of a standard type together with developing times for fast and slow types of film. The price of the Souplinox is £1 8s. 6d.

SYNTHACOLOR NEGATIVE PROCESSING KITS

(British Synthacol Ltd., Rowsley Works, Reddish, near Stockport, Cheshire)

Although the manufacturers of these processing kits are not at the present time manufacturing a colour negative film it is suggested that the kits are suitable for the development of the three colour negative films which are at present available on the British market.

The kit comprises four solutions which are supplied as powder chemicals packed in five tins, making one litre of solution each with the exception of the intermediate stop bath which makes two litres. The four solutions are the colour developer, an intermediate bath, a bleach bath, and a final fixing bath. It will be seen that a combined bleach-fix such as is commonly used for the processing of colour negative materials is not here supplied. All the chemicals dissolve readily and the solutions may be made up quickly; the colour developer however, as is usual with such solutions for colour negative materials, must be allowed to stand for twelve hours before use.

Comparative tests were made on the three makes of colour negative available to determine the colour balance and gradation given by the Synthacolor negative processing kit and the official processing chemicals or service offered by the manufacturer. In each case the Synthacolor kit gave extremely similar results to those given by the official processing both as regards colour balance and the gradation of the negatives. For the Pakolor negatives a somewhat different filter pack would be needed for the two differently processed films but this change would not be greater than the normal amount of filter correction needed.

Thus the Synthacolor colour negative processing kits are a most useful product and provide the photographer with an alternative source of processing solutions at reasonable cost. All the components of the kit may be obtained separately, a useful point since it is not advisable to use the colour developer and intermediate stop bath more than once, whereas the bleach and the fixer will handle a fair quantity of film before exhaustion.

SYNTHACOLOR PAPER AND PRINTING AND PROCESSING KITS

(British Synthacol Ltd., Rowsley Works, Reddish, near Stockport, Cheshire)

Synthacolor paper is a colour positive material of the conventional type for the making of prints from colour negatives either by contact or by enlargement.

The printing kit comprises a supply of the paper in $3\frac{1}{2} \times 2\frac{1}{2}$-in.

size, 36 gelatine colour correction filters, and a glass filter which gives a basic modification of the colour temperature of the light source. The colour correction filters consist of three sets of twelve filters, yellow, cyan and magenta in density steps of 0.05 from 0.05 to 0.60. Since the paper, like any colour printing paper, is panchromatic it has to be handled in the light of a green safelight of low brightness, though the amount of light which it passes is appreciably greater than a normal panchromatic safelight screen.

The processing outfit for paper comprises five solutions one of which is divided into two portions for use, thus needing six dishes in the darkroom. All the chemicals except the stop bath are supplied as powders which make one litre of solution.

After the first fixer the green safelight may be changed for a much brighter orange or yellow-green but the print cannot be viewed in white light until after the final fixing bath. The complete processing routine takes some 59 min. and a test print can be assessed for colour balance after some 39 min.

The recommended light source for the enlarger or printing box is a standard high intensity enlarging bulb and the basic correction filter, called an R filter, has to be inserted into the light path.

Since the colour paper has similar speed to a normal black-and-white bromide paper it is recommended that a black-and-white print be first made from the colour negative and after development this can be assessed for exposure. This same exposure time is then used for a no-filter print on the colour paper test strip (test strips are included in the packets of paper).

Prints of similar quality to those made on any other colour paper can be made on the Synthacolor material and it would seem to be possible to print from any of the three types of colour negative films currently available using correction filters within the normal range. As with all materials of this type care in processing is needed if the whites of the print are not to be degraded with a colour stain.

The paper is available in both 10 and 25 sheet packets in $3\frac{1}{2} \times 2\frac{1}{2}$ and $6\frac{1}{2} \times 4\frac{3}{4}$-in. sizes only. All sizes and packings are on a double-weight base. The green safelight, Synthacolor No. 1, is available in 7×5, 10×8, and 12×10-in. sizes and replacement chemicals for all the baths in the processing kit may be obtained.

PHOTOLITA REFLECTOR PHOTOFLOOD LAMPS

(Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2)

These two new Philips lamps conform in rating to the two commonly used photoflood types; the smaller is a lamp of 275-watt consumption with an objective life of three hours and the larger has a consumption of 500 watts with a life of six hours.

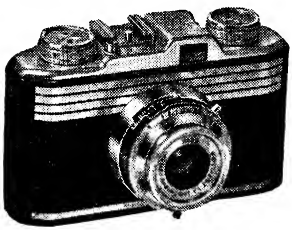
Both lamps are available with either a B.C. or E.S. cap and in voltages from 100 to 250. The front face is lightly frosted and in use we found that the light which they give is fairly soft and pleasant. Due to their fairly large source area the lamps will not, of course, give the shadows with a wire sharp edge such as a true spotlight will, but both lamps concentrate the light into a beam very effectively with the minimum of spill. The approximate beam candle power for the S.M. (275-watt) lamp is 3,600 and for the N.M. (500-watt) lamp is 10,000 measured on the 220-volt type. The colour temperature at which these lamps operate is 3,400, $\pm$ 50 degs. Kelvin, that is the same as the standard range of lamps for colour photography known as C.P. lamps. This colour temperature is correct for colour films with Type A sensitivity. The 200-deg. Kelvin correction for films of Type B sensitivity can be simply adjusted with a very light filter on the camera although for colour negative materials the correction is within the limits possible in printing.

A useful table of guide numbers, similar to those supplied with Philips Photoflux lamps is supplied with the Photolita lamps and the prices are 13s. for the S.M. and 22s. for the N.M.

ILOCA QUICK CAMERA

(Photax (London) Ltd., 70 Charlotte Street, London, W.1)

Within the limitations of a conventional 35-mm. camera with a fixed lens the Iloca Quick has a number of attractive features. Basically it is a simple and reasonably priced model with an f/3.5 45-mm. Iltar anastigmat lens mounted in a Prontor S shutter giving 36 exposures of the standard 36 × 24-mm. format. The body is an alloy die-casting covered in black ribbed plastic with a chrome trim, and an excellent quality direct vision finder is fitted into the top plate between the wind and rewind knobs for the film.



The camera sits comfortably in the hands and a body release is fitted for operation by the right forefinger. The film wind knob is coupled to the shutter setting and a new feature on the Prontor-S, a small red indicator, shows when the shutter is set ready to fire. The film wind is automatic, in the sense that only the correct amount of film can be wound on. A take-up spool of generous size helps to give reasonably constant picture spacing throughout the length of the film.

The camera is opened in a rather novel fashion. The rewind knob is simply pulled out as far as it will go and then given a slight clockwise turn. This releases the back which then springs open slightly of its own accord. In this way there are no projecting catches or locks which may be accidentally opened, and the body of the camera is quite plain. The rewind release consists of a small button in the base of the camera and this has to be pressed inwards during the time the film is being rewound.

The lens is fitted with front cell focussing and the tripod bush is provided in the camera base. The price of the Iloca Quick is £15 3s. 6d. plus £4 18s. 8d. purchase tax.

LIQUID STOP BATH WITH INDICATOR

(Kodak Limited, Kingsway, London, W.C.2)

The use of an acid stop bath involves some uncertainty in knowing when the bath should be discarded. This problem has been overcome by the Indicator feature of this new product for arresting development because the user can see when the solution should be renewed; the bath begins to turn mauve when it is nearing the point of exhaustion, and it therefore appears to darken when viewed in the safelight illumination. The stop bath is yellow when it is freshly made.

The stop bath is prepared by adding 4 oz. of stock solution to sufficient cold water to make 1 gal., and it is used at a temperature of 60 degs. to 70 degs. F. The material—print or negative—is drained after development and is then kept moving in the stop bath for approximately 10 sec., after which it is transferred to the fixing bath.

Unused, diluted solution will keep for three days in an open dish at 75 degs. F. or lower, for one month in a tank, while if in a stoppered bottle it will keep indefinitely.

The Stop Bath with Indicator is sold in 20-oz. bottles at 7s.

SYTEC 2 × 2-in. SLIDES

(The Scientific and Technical Camera Co., Ltd., Hawkers Buildings, Davigdor Road, Hove, Sussex)

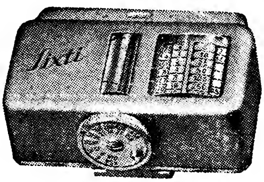
These metal slides are similar to the original pattern Sytec slide, in which the transparency is held between two glasses which are 34 × 38-mm. in size and placed between six locating strips pressed into the metal holder. This assembly is then slid into the other half of the metal holder, the two fitting together drawer fashion. The design of the metal holder has now been modified by pressing a shallow rebate into which the glasses fit. This has had the effect of reducing the overall thickness of the slide from 3.25-mm. to 2.5-mm.

The slides are nicely made from light gauge polished aluminium with the 23 × 34-mm. projection aperture cut out clean and square. Correct placing of the slide in the projector is shown by two indents pressed into the metal. The indent not used for this purpose is used for an index slip supplied, ten of which are supplied with each box of ten slides. These index slips are adhesive on the back, not with gum, but what appears to be rubber mountant. Two spare glasses are supplied with each box of twenty-five slides in case of breakage. These slides conform to B.S. 1917 : 1952 and American Standard Z38.7.13—1944. The price of a box of ten slides is 7s. 6d., and a box of twenty-five 17s. 6d.

SIXTI EXPOSURE METER

(Photax (London) Ltd., 70 Charlotte Street, London, W.1)

This meter is a good example of the currently popular trend toward a smaller meter which can be conveniently fitted to the accessory shoe now provided on the top plate of many cameras. With a meter as well finished and compact as the Sixti there is no doubt that this position is a good deal more sensible than the laborious carrying of a meter in a separate carrying case, since it detracts in no way from the appearance of the camera.



Along with the reduction in size of meters of this type has come a simplification of the calculator which is needed with all photoelectric meters. In the case of the Sixti, once the film speed has been set it is only necessary to turn a single small disc at the back of the meter until the galvanometer pointer lies on a small index mark visible through a narrow slot beneath it. Turning the disc also turns the stop scales which are marked on a pair of rollers visible through a window with a magnifier to the right of the meter needle window. Change from high sensitivity to low is automatically taken care of by the meter as the setting disc is rotated. Shutter speeds from 30 seconds to 1/500 are marked and stop settings from f/1.4 to f/45.

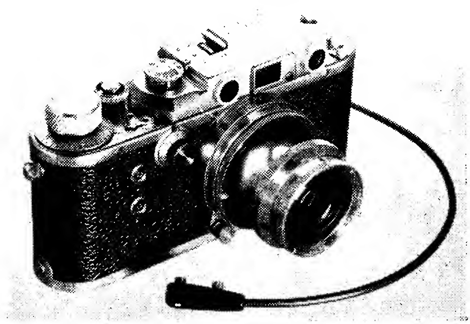
For reflected light readings the meter is used as it is supplied, with the cell covered by a honeycomb window. However, should it be desired to take incident light readings a simple diffuser of white plastic is slipped over the window without any need for reference to a separate set of scales on the meter.

The foot which is fitted into the accessory shoe on the camera is adjustable for position through about 1¼-ins. between centres to allow fitting to individual patterns of camera. Altogether a well thought out and well made meter; price is £8 15s. 6d. plus £2 17s. 0d. purchase tax.

REID CAMERA

(Reid and Sigrist, Ltd., Braunstone Works, Braunstone, Leicester)

Most photographers will by now be familiar with the Reid camera, but a new model is now available which has built-in flash synchronisation. In all other respects the camera is identical with the earlier model, the design of which is based on well-known and well-tried principles.



The flash connections are made through a pair of sockets on the front of the camera slightly below, and to the right of, the slow-speed setting dial. One of these sockets is marked E and the other B, as can be seen in the illustration. A two-pin plug of unusual design is used to connect the flashgun to the camera through these sockets; the upper end of the plug carries the contact pin mounted co-axially in a short length of split tube to provide holding friction. At the lower end of the plug is a dummy connection which serves simply to register with the socket, B or E, which is not being used.

When the plug is orientated so that the connection is made with the socket marked E internal contact is made by the shutter-blind with correct timing for electronic flash equipment or flash bulbs of F class (5 milliseconds delay) such as the Speed Midget and P.F.S. Used in this fashion the shutter is set for an exposure time of 1/20 second. When the socket marked B is used the synchronisation is correct for any of the expendable bulbs of the FP class, which are specially intended for use with cameras having focal-plane shutters. In addition to the bulbs specially designed for this purpose, the Philips PF 60, which is an M-class bulb, has also been found satisfactory on the B setting of the Reid, at shutter speeds from 1/100 second to 1/1000 second.

The price of the fully synchronised Reid camera is £90, plus £30 purchase tax.

ACTINO U UNIVERSAL EXPOSURE METER

(Actina Ltd., 10 Dane Street, High Holborn, London, W.C.2)

In size and shape this new Actino exposure meter is identical with the Actino and Super Actino meters which were reviewed in the 1953 *Almanac*. The same simple and convenient direct-reading system is adopted in the Actino U as in the earlier models. The meter is simply pointed toward the subject in the conventional fashion whereupon, provided always that there is sufficient light, the meter needle will move across to a certain point between its limits of travel.

The meter carries no calibrated scale but the needle of the microammeter traverses a range of twelve segments alternately black and white. On rotating the knurled-edge disc which carries the aperture calibrations from f/1.4 to f/22, a red index mark can be brought round to the segment at which the meter needle has come to rest and the desired shutter speed and aperture combination can then be read off the disc. Outside the range of shutter-speed calibrations is a further range of film speeds for movie cameras covering the range from 8 to 64 frames/sec., hence the classification of the meter as universal. Before use the film-speed index, either DIN or ASA, must be set in one of the two apertures in the centre disc.

The Actino U differs from its predecessors in that the body is made from an attractive pearl-grey plastic, and instead of a permanently fitted case a snake chain with a snap-hook is supplied. The cell is covered when not in use by a white plastic-hinged cover which enables the meter to be used for incident light measurements. The price of this attractive meter is £4 10s. 6d. plus £1 9s. 5d. purchase tax.

NATIONAL FIVE-FOUR DOUBLE DARK SLIDES

(Pelling and Cross Ltd., 104 Baker Street, London, W.1)

The increasing use of the 5×4-in. film and plate size has led a number of manufacturers to offer double dark slides to suit the cameras which use it. This new National slide is among the best we have seen and the quality of the workmanship can leave nothing to be desired. The slides are available for either sheet film or plates and are made in two types, a standard pattern and a de luxe.

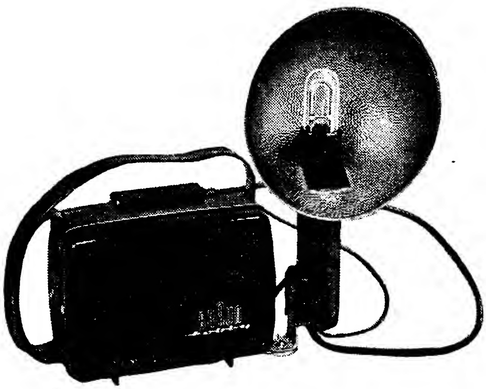
In both patterns the slide body is made from wood with a light alloy insert at the top of each front face; this insert carries the thin rib which locates in a mating groove in the camera body and prevents the slide pulling out from behind the spring back when the sheath is withdrawn. The machining of both the wood and the metal parts is of very high quality. The sheath is made from black plastic sheeting with a metal rib along the upper edge where it is gripped for withdrawal. One side of this metal rib is finished in black and the other polished, for identification of exposed and unexposed films.

The de luxe model has the benefit of an extra hand-finishing process, and replacement of the sheath has been made especially easy. Both of these slides can be highly recommended as quality products; they are easy to load and use and the finish is in every way excellent. The price of the standard pattern is £2 10s. 0d., and the de luxe £3 0s. 0d.

HOBBY ELECTRONIC FLASH UNIT

(Photax (London) Ltd., 70 Charlotte Street, London, W.1)

This unit represents what might well be called the conventional type of electronic flash unit at its most compact and lightest. The weight of the power pack is but 4½-lbs. and within the compass of its 7½ × 5½ × 3½-in. casing it contains a 4-volt accumulator, a vibrator, a rectifier, and a condenser. The layout is among the most compact we have seen in any electronic flash outfit but at the same time nothing appears to have been sacrificed in the quality of the workmanship or components.



The outer case of the power pack is of black plastic and two state-of-charge indicators for the accumulators are visible from the back of the casing. In addition to the normal operation of the power pack it can also be used to charge its own accumulator from alternating current mains by simply plugging in a mains lead. This lead incorporates a resistance, so that the set can be charged from either 110 volt or 220 volt by a simple change over.

The flash head is of apparently conventional design with a black plastic holder, chromed camera bracket and a highly polished 7-in. reflector. Further examination reveals, however, that the reflector itself is also made of a black flexible plastic with a highly reflective metal plating on its inner surface. The single U-type tube is fitted, within its outer safety cover, straight into the top of the holder.

The power pack can be switched on from the flash head and a ready-to-fire neon is also fitted. A synchronising lead is permanently fitted, and for open flash firing the unit can be triggered from a small red button into the bottom of the flash head.

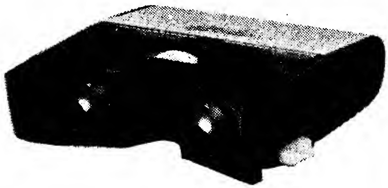
The unit is rated at 90 joules output and with a film speed rating of 32° B.S. a flash factor of 52 can safely be used. For a colour film with a speed rating of 24° B.S. a flash factor of 26 as recommended gave a nicely exposed transparency.

The price of the Braun Hobby electronic flash unit is £25 5s. 0d. plus £8 4s. 2d. purchase tax.

ILOCA STEREO VIEWER

(Photax (London) Ltd., 70 Charlotte Street, London, W.1)

This is a most attractively styled viewer for stereo slides made on 35-mm. film and mounted between American standard glasses. The basis of the viewer is an alloy casting which is shaped at the forward end to fit the face of the user and gives good exclusion of extraneous light.



A pair of achromatic lenses are fitted to the viewer and these can be both focussed and adjusted for interocular separation; the former adjustment is by means of a white knob which slides over an arc on the right hand side of the viewer, the latter by means of white plastic disc with a milled edge which projects slightly from the top of the viewer.

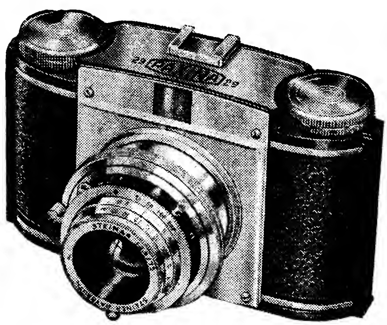
The lamp which provides the illumination is fed from two $1\frac{1}{2}$-volt dry cells contained at the back of the body and the lamp is switched on by placing the slide in the viewing position. A second cut-out switch is fitted into the base of the viewer so that when it is laid down on the table with a slide in place the lamp is automatically switched off.

The finish of the viewer is a fine black crackle enamel with the removable cover in grey. The price of this stylish and attractive viewer is £7 5s. 0d.

PAXINA 29 CAMERA

(Neville Brown & Co. Ltd., 77 Newman Street, London, W.1)

The Paxina 29 is a camera designed for twelve pictures $2\frac{1}{4}$-in. square on size 120 rollfilm. In styling, however, it more nearly resembles a miniature camera for the lens is supported on a large diameter extending tubular mounting and must be withdrawn before the camera can be used.



The body of the camera is an alloy die-casting covered in black leather cloth with the top and bottom plates enamelled black. The draw tube on which the lens is supported, and its mounting are bright and matt chrome respectively. Thus it will be seen that the camera presents a most attractive appearance. As the name of this model suggests, the camera is fitted with a Steinar f/2.9 lens; the focal length of this is 75-mm. and focussing is by rotation of the front cell. The lens is fitted in a Pronto shutter speeded from 1/25 to 1/200 second with a B setting. The shutter is synchronised for flash and has a delayed action release. A body release is not fitted to the camera but the shutter release is large and easy to reach with the forefinger of the right hand when the camera is held at eye-level.

A direct vision optical finder is contained within the top plate of the camera which is slightly curved downwards toward the outer ends. This gives a smooth flowing line to the top of the camera since the ends of the top plate are thus flush with the film wind knob and its companion knob at the opposite end of the camera. An accessory shoe is fitted to the top of the camera above the finder. The film indicator window in the camera back is fitted with a safety cover and the tripod bush is mounted in the centre of the base plate. Altogether the Paxina 29 is a nicely made and compact camera for 2¼-in. square pictures with a fast lens of adequate quality. The price is £11 1s. 10d. plus £3 12s. 2d. purchase tax.

ARGAPHOTO REFLECTOR LAMP TYPE B.M.

(Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2)

This lamp is a further addition to the range of reflector flood lamps designed for photographic purposes manufactured by this company. The Argaphoto type B.M. is, however, a much larger lamp than the Photolita types. The overall dimensions are length 220 mm., diameter 156 mm., and the lamp is supplied only with an E.S. cap. The electrical consumption is 500 watts with an objective life of 100 hours, and the voltage ranges covered are 100-130 and 200-260.

Unlike the lamps already mentioned the colour temperature at which the Argaphoto Type B.M. operates is 3,200 degs. Kelvin, ±50 degs., and thus colour film with Type B sensitivity can be used with this lamp without correction filters on the lens.

For locations in which a large quantity of light is required these lamps will enable a large saving in weight to be made since the bulk of the light output from the filament is directed forward whilst at the same time the large and heavy housings which are generally used with a lamp of this size can be dispensed with. The price of the Argaphoto Type B.M. is £2 4s.

SOFT GRADATION DEVELOPER POWDER

(Kodak Ltd., Kingsway, London, W.C.2)

As its name suggests this developer is specifically intended to give low contrast results and tests show that for this purpose it is a very satisfactory product. It is a particularly useful developer for processing masks and on a plate such as the P.1200 Soft Gradation developer may be used in place of the usually recommended D.23. For a gamma of 0.5 a development time of 3 min. with continuous agitation in a dish proved satisfactory. For masks on the blue sensitive plates of the B.40 type the development time would be of the order of 1½ min. with continuous agitation and 3 min. with intermittent agitation. All these times are for a temperature of 68 degs. Fahrenheit.

This developer can also be used to produce soft results on bromide and chloro-bromide papers with development times of the order of 3 minutes. For all of these purposes the developer is made up as a stock solution which is diluted 1+3 for use. The price of sufficient powder to make 80 oz. of stock solution is 4s. 9d., and a larger size to make 1¼ galls. of stock is 10s. 6d.

ILFORD ROLL HEAD PRINTER

(Ilford Ltd., Ilford, London)

The Ilford Roll Head Printer is built in the form of a table into the top of which are conveniently and compactly incorporated all the working parts of the printer. At the back of the table is held the 250-ft. roll of paper on which the prints are made, the width of this being 3½-in. The paper is fed toward the operator emulsion down over the exposure aperture and after exposure passes through a slot and appears beneath the table top.

From 2¼ × 3¼-in. negatives, which size forms by far the greatest bulk of negatives dealt with by photo-finishers, only one cut is needed to separate the prints, and provided the correct amount of paper is fed from the roll for each exposure an even ¼-in. border is obtained on each print.

The paper is fed from the roll automatically by two rubber-surfaced rollers mounted at the front of the paper chamber. The upper of the two rollers is weighted and presses the paper firmly into contact with the lower roller. The platen of the printer head which applies the pressure to the paper to force it into contact with the negative is normally held in a vertical position so that the negative can be centred over the exposure aperture by the light of the internal safelight; when the platen is pulled down by the operator in order to make the exposure a stranded steel cable which is attached to it on the right-hand side revolves the lower of the two paper feed rollers and thus moves a fresh length of paper into position over the negative in readiness for the exposure. The exposing lights are automatically switched on as soon as the platen is applying pressure.

The film, which is, of course, at this stage still in strip form with its clip and order docket attached, is fed across the exposure aperture from left to right, and as the first negative is in the printing position the second is in the grading position. When the first print of the roll has been exposed the platen handle is moved back past the " neutral " position, whereupon it switches on the grading lamp. The light from this lamp, after diffusion, passes through the negative and falls on a photo-cell. The area of the negative which is seen by the photo-cell is a circle some 1½-in. in diameter so the reading can be assumed to be a fairly average density reading for the whole negative. The micro-ammeter which indicates the current generated by the cell is scaled from zero to nine and these figures refer to the ten push-buttons which are fitted in the front of the table immediately before the operator. No skill whatever is needed in exposure assessment: the button which corresponds to the meter reading gives the correct exposure. If the indication on the meter falls exactly between buttons three and four, for example, then the higher number button is used always. It can be seen from this that the operating speed of the printer is high and it is perfectly possible for an unskilled operator of reasonable intelligence to use the machine. The only time at which any judgment is needed is for a negative which is so dense that the meter reads zero. For these button 0 is pushed and the operator gives a longer exposure according to his estimate using the button which is fitted on the front edge of the table on the left.

The exposure set up by the buttons is of fixed time and variable intensity, the intensity of the four exposing lamps being varied by the amount of series resistance which is switched into circuit by the buttons. The actual time of exposure is controlled by a clock movement which is set in operation by a microswitch operated by the platen and is rather less than one second in duration.

On lifting the table top to the left of the head of the printer the whole electrical chassis of the printer is exposed for servicing. The clock mechanism is mounted on its own sub-chassis and can thus be removed by simply unplugging the connecting lead and replaced should this ever be necessary.

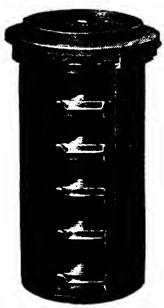
The printer is finished most attractively in cream glossy enamel with the table top in matt black. In use it was found simple and fast, the platen operating lever falling nicely to hand and a regular rhythm of grading, button selection, and exposure soon acquired. The manufacturers claim that upwards of 600 prints an hour can be maintained with only a little experience and we would think that higher speeds would be well within the bounds of possibility.

The complete Ilford Roll Head Printer costs £172 10s., and a unit for the conversion of standard printers to roll head type is also obtainable for £52 10s., which includes the cost of modification.

JOBO STORY DEVELOPING TANK

(Photo-Science Ltd., 10 North End Parade, W. Kensington, London, W.14)

This tank represents an attempt to put the small scale or individual processing of roll films on to a semi-mass production basis. The Story consists of a perfectly conventional tank such as is used for the development of roll films on a spiral holder, with the difference that it is some 9-inches high; within this tank is contained a set of five spiral holders on a single central column.



The five spirals may be used to develop five full 36 exposure lengths of 35-mm. film, or, by reducing the number to three with the interposition of the necessary spacing rings, up to six 120 or 620 films may be processed at the same time. So that the two size 20 films which are inserted into the spirals one after the other do not overlap, the adjoining ends are bent at right angles in opposite directions. For the maximum number of films of either size a little over 70 ounces of solutions are required; for less than the maximum quantity the necessary amounts of the solutions are given on a table moulded into the tank lid.

It is obvious that with a tank of this size one of the most important considerations will be the speed with which the solutions can be poured both into and out of the tank. In this respect the Jobo Story tank performs well. The inlet and outlet are both of generous size; however it is suggested by the manufacturers that the spiral holders should be loaded with the films and then lowered into the tank full of solution in the dark. In this way the development process can be started with the minimum delay between the top and bottom films. The price of the Jobo Story tank is £5 5s. 6d.

LINHOF REPORTER PAN AND TILT HEAD

(Milbo Photographic Ltd., 4 Macclesfield Street, London, W.1)

This is an excellent and thoughtfully designed head which is sufficiently solid to cope with any 16-mm. cine camera and still cameras up to quite large plate size. The operating handle, which is some 7-in. long and has a large diameter plastic hand grip, locks both the pan and the tilt movements of the head, and a half-turn of this handle is sufficient to free the movements completely. The handle can be fitted into either of two sockets so that the head may be used either right-handed or left-handed as the operator may desire.

·Both the pan and the tilt movements are calibrated plainly in red, and the tilt scale is provided with a double index mark to cope with either right- or left-hand operation. A small circular spirit level is provided for the initial setting up of the tripod and its head.

The tripod screw which fits into the camera body can be used with cameras having either a British or a Continental bush, the larger diameter thread being cut into a sleeve which fits over the smaller. This sleeve is spring loaded so that whichever pattern is needed the camera is simply placed on the screw and a large knurled knob rotated to tighten it.

The body of the Reporter head is finished in silvery-grey hammer lacquer with the edge of the camera platform chromium plated. The top of the platform on which the camera rests is covered in black leatherette. The price of this useful accessory is £4 13s. 9d., plus £1 10s. 6d. purchase tax.

CAPITOL DEVELOPER

(Johnsons of Hendon, Hendon Way, London, N.W.4)

Capitol is an interesting new developer which behaves in a most unusual fashion. The now well-known techniques for increasing film speed such as extending the development time or developing at elevated temperatures at the same time increase the contrast of the negatives produced and limit the subject brightness range which can be handled. When a test of such a method is plotted as a set of characteristic curves the effects can be clearly seen.

A set of curves for Capitol however show a rather remarkable and unexpected feature. As the development time is increased the contrast increases only slightly, if at all, and the curves move progressively further and further to the left on the paper. That is to say, increasing the development times simply gives the film higher effective speed without increasing the contrast beyond a reasonable figure.

When compared with a fine grain developer which gives normal film speed, Capitol, even at the shortest developing time recommended for this film, gives a speed increase of 2 degs., and when the development time is extended to 22 mins. the speed increase becomes a total of 4 degs. From curiosity a fourth test was made with a development time of 30 mins. although the manufacturers of the developer state that the maximum time recommended should not be exceeded without test since there is a risk of fog and grain and a possibility that the speed will not increase. In the case of H.P.3 at least the fog level is rather high, 0.57, but not impossibly so, and further considerable gain in speed is evident, a matter of 6 degs. in all.

Graininess tests have shown that for the maximum speed ratings an enlargement of six times ought to be possible without too obtrusive grain, and at the normal rating—that is, normal for Capitol—the grain is about the same as with D-23. The 10 × 8-in. prints from about 2 in. of the width of the 2¼-in. square test film were certainly perfectly adequate so far as grain was concerned.

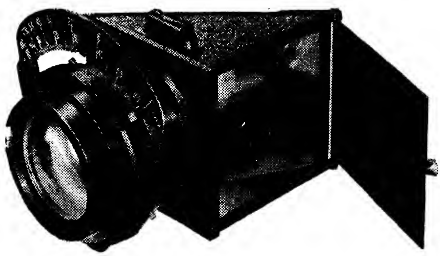
It is expressly stated by the makers that the working solution of Capitol should not be used more than once. This may seem expensive, but it should be noted that little is lost in development time by using the 1+7 dilution which gives three tankfuls to the 8-oz. bottle. On the other hand, for those stalwarts who persist in using see-saw dish development, 3 oz. of the 1+4 dilution are adequate for a size 20 film.

Thus it will be seen that Capitol is no stunt, it does all that its makers claim it will do, and there are apparently no snags or drawbacks. Not all films will give speed increases such as the above tests showed, but all those in common use behave well; a complete list of speed ratings for all the films in use in this country is given in the instruction sheet. The developer is supplied as a concentrated solution which is diluted for use either 1+4 or 1+7, the lower concentration giving the same speeds but with slightly longer development times. An 8 oz. bottle of concentrated solution costs 3s. 6d., a 20 oz. costs 6s. 6d., and the 80-oz. size costs 17s. 6d.

ROSS APO PROCESS LENSES AND PRISMS

(Ross Ensign Ltd., Fulbourne Rd., Walthamstow, London, E.17)

The blockmaker and the process engraver necessarily demand the highest of quality in the lenses which are designed to work under their somewhat unusual conditions. The need for exact register of three or four colour separation records, the relatively similar object and image conjugates and the necessity for the use of a prism for image reversal are all factors which lead to a radically different design optimum with a process lens.



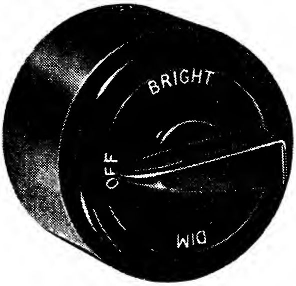
The latest series of Ross process lenses are made to the highest of standards in this field and can be relied upon for excellent definition and colour correction. The 9½-in. lens sent for test has a maximum aperture of f/10, the diaphragm is scaled in f/ numbers down to f/90 and also in millimetres opening. The lens mount is slotted for the insertion of a Waterhouse stop or gelatin filter; the slot is marked off in degrees corresponding to screen angles.

The lens is available in a range of nine focal lengths from 9½-ins. (241-mm.) to 48-ins. (1,219-mm.). All focal lengths up to the 25-in. (635-mm.) have a maximum aperture of f/10 and the longer focal lengths have a maximum aperture of f/12.5. The prices of these lenses range from £38 0s. 0d. for the 9½-in. up to £275 0s. 0d. for the 48-in.

SERIES-PARALLEL SWITCH

(The Pullin Optical Co. Ltd., Pullin House, South Ealing Rd., London, W.5)

The advantages of series-parallel switching of Photoflood lamps are by now quite generally appreciated but although this system is electrically quite simple suitable components are not always easy to come by. Hence this switch which is specifically designed for this purpose is a welcome addition to the range of products of the Pullin Optical Co. Ltd.



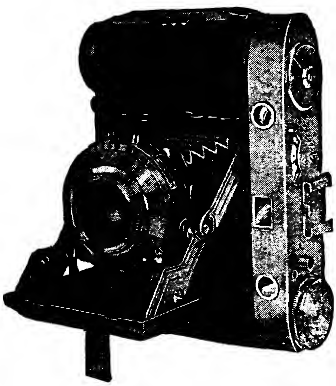
The switch takes the form of a standard size rotary switch with the top cover marked " Dim " and " Bright " with two intermediate off positions.

The maximum current carrying capacity of the switch is 10 amps. and the lamps up to this total wattage must be arranged in two banks of equal wattage. A wiring diagram which shows how the switch should be put into operation is provided and this should present no difficulties to even those photographers who have little electrical experience. The price of the Pullin series-parallel switch is £1 5s. 3d.

RANGEFINDER BALDINETTE CAMERA

(J. J. Silber Ltd., 51/52 Avenue Chambers, Vernon Place, London, W.C.1)

There can be no doubt that the addition of a coupled rangefinder adds considerably to the complexity of any camera. In the case of a miniature camera where the designer's aim is generally to keep bulk down to the minimum the problem becomes even more serious. In one or two instances in recent years cameras with rangefinders which are not coupled to the lens focussing have appeared, and there is no doubt that this represents a useful compromise arrangement. The Rangefinder Baldinette is a camera of this type.



In use the manipulation of the rangefinder and transfer of the reading obtained to the front cell of the lens proves little more difficult or time consuming than the straightforward coupled type of rangefinding. The rangefinder is operated from a milled disc which protrudes slightly from the top plate of the camera at the back and the reading is made through a quarter circle slot in the top of the camera. The camera has to be used with the right eye at the rangefinder eyepiece so as to free the adjusting disc. The viewfinder is of the direct vision optical type and the eyepiece of this is mounted to the right of the rangefinder eyepiece.

The remainder of the specification of the Baldinette corresponds with normal design. The camera takes 36 pictures on a standard packing of 35-mm. film and the lens panel is mounted on the usual struts and drop baseboard, with bellows connecting lens and body, which have become typical of the design of cameras by this manufacturer over a period of many years.

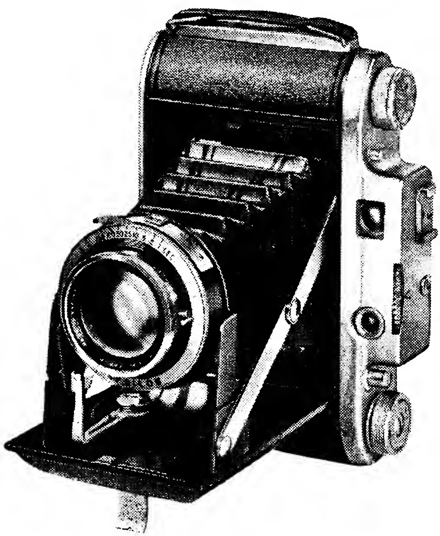
The lens fitted to the camera is a Baldanar coated anastigmat of 50-mm. focal length and f/3.5 aperture. The shutter is a Prohtor S speeded from 1 sec. to 1/300 sec. with a B setting. The shutter is synchronised for flash and provided with a delayed action release. A body shutter release is fitted for operation by the left forefinger and the shutter release and film wind are interlocked. A tiny red indicator in the top panel of the camera shows when the film has not been wound on after making an exposure.

The body of the camera is all metal and covered with black leather. The top plate, struts and lens panel are all finished in matt chrome. The price of the Rangefinder Baldinette is £18 14s. 9d. plus £5 17s. 9d. purchase tax.

ENSIGN SELFIX 820 SPECIAL

(Ross Ensign Ltd., Fulbourne Road, Walthamstow, London, E.17)

This camera is a modified version of the well-known Ensign Selfix 820 which in addition to the features of the latter model also has a rangefinder. This rangefinder is not coupled to the lens focussing, the readings which it gives are simply transferred to the front cell scaling on the lens.



The body of the Selfix 820 is of pressed metal construction and is extremely ruggedly built. Basically the camera is intended for eight pictures on either 120 or 620 roll films but by means of a pair of built-in mask plates the picture size may be reduced to 2¼-in.square. Alternative film number windows are provided for the two sizes.

The lens is a Ross Xpres which is coated; maximum aperture is f/3.8 and the focal length 105-mm. The lens is fitted into an Epsilon shutter which is speeded from 1 sec. to 1/250 sec. Both Brief Time and Time exposure settings are provided. The shutter is synchronised for flash, both electronic and expendable bulbs. A somewhat novel method of choice of the delay which the shutter provides has been adopted; two sockets for the synchronising lead to the flashgun are provided side by side, one for the X delay and the other for the F delay. These sockets are of the standard Compur pattern.

The camera is of the drop baseboard pattern and the lens panel is rigidly supported by the struts and locking arms. The camera does not spring into the operating position when it is opened by the release button, the majority of the lens travel has to be done manually. A body release is provided on the left of the top plate on the camera body and this release is interlocked with the film wind.

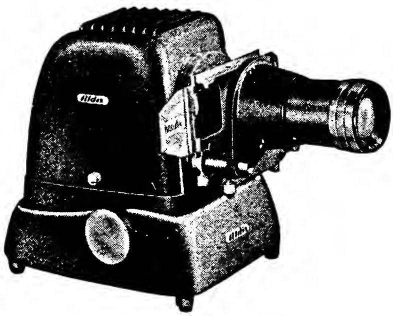
The rangefinder is contained within the top plate of the camera and is operated by means of a large diameter disc which projects toward the front of the camera at the top. This disc is turned with the left forefinger and when the two images seen in the viewfinder coincide the distance of the object can be read off the top surface of the disc. The main field of the rangefinder/viewfinder is yellow in colour, the centre spot is unfiltered. A small sliding mask is provided on the front window of the finder for use with the 2¼ square film size.

A depth of field calculator is fitted to the knob on the right of the camera body. The camera is finished in matt chrome of high quality and black leather. The price is £20 0s. 0d. plus £6 10s. 0d. purchase tax.

ALDIS STAR PROJECTORS

(Neville Brown & Co. Ltd., 77 Newman Street, London, W.1)

The most interesting and attractive feature of this range of projectors is undoubtedly the fact that the lamps are all operated directly from the mains. Even a transformer does not achieve 100% efficiency in converting the voltage down to the figure required for the low voltage lamps which have hitherto been used in projectors of this type. In addition the weight of a transformer which can supply sufficient current for a high wattage lamp is no inconsiderable factor. Thus the use of mains voltage lamps is a great convenience.



In appearance all of these projectors conform to the general Aldis pattern; the 300 watt model has no forced draught cooling, but all the larger wattage models, the 500, and the 750 have this feature. The motors of the cooling fan can be operated only from alternating current mains.

The standard focal length lens for all models is a 4-inch f/2.8 anastigmat, but the lens is interchangeable and either a 2-inch or a 6-inch can be fitted if the projection conditions demand this. For the 2-inch lens a supplementary condenser must be fitted but this is supplied with the projection lens and is included in the purchase price of the latter.

By virtue of the highly efficient optical system and the wide aperture of the objective the screen brightness given by all these projectors is extremely high, and by choice of lamp wattage screens of suitable size for an extremely wide range of purposes can be used with an adequately illuminated picture. At the same time the provision of forced draught and a heat filter ensures that the slide is kept cool.

A range of accessories enables the projectors to be used for the projection of filmstrips and micro slides in additon to the regular 2 × 2-inch slides for which the projector is specifically intended. The projectors are finished in brown crackle enamel with the slide carrier matt chrome. The price of the 300 watt Star projector is £19 19s. 0d., the 500 watt £25 0s. 0d., and the 750 watt £38 1s. 0d.

MULTIGRADE PAPER

(Ilford Ltd., Ilford, London)

The manufacture of Multigrade was discontinued during the war but has now been started once again, albeit with some minor changes in the filters with which it is used, and to the properties of the paper itself.

As originally manufactured the paper was used with a series of filters which ranged from blue to yellow, the blue filters being used to give the lowest contrast and the yellow the highest contrast. With the material as currently manufactured only three yellow filters are used which together with the use of the paper without a filter gives four basic grades—from soft with no filter to hard with the deepest yellow filter.

The filters supplied are of gelatine mounted in a simple card holder to avoid handling and the surfaces of the gelatine are lacquered to provide some extra protection against finger marking. The paper is supplied in two surfaces, velvet stipple and glossy.

Estimated in terms of the log. exposure scale at the two extremes of contrast Multigrade is comparable in range with normal Ilford bromide paper or Plastika in the soft and hard grades (1 and 3).

The use of filters over the enlarger lens will naturally cause some alteration to the exposure to be needed on changing from one contrast to another. The manufacturers suggest that taking the exposure needed for the medium-grade filter as 1 the change to the high-contrast filter will need an exposure of 1½. Change to the low-contrast filter will need ⅔ the exposure and used with no filter the exposure will be halved. Such exposure correction factors will, of course, depend on which tone in the print it is desired to maintain constant through the contrast change. Measurements made at a mid-density on the curves shown in the illustration show that the factors given are roughly correct under the conditions pertaining to the test.

By virtue of the added green sensitivity of the Multigrade emulsion the paper can only be handled in a rather deeper safelight than is normally used for bromide papers, the Ilford S, which is light brown, or the Wratten 1, which is red, are equally suitable. Any developer of the type used for papers may be used; ID 20 and PFP are recommended, but in development the paper exhibits a somewhat unusual effect. The normal development times are from 1½ to 2 minutes, 2 minutes being suggested for test strips. However, development may be continued up to 3 minutes but it must be noted that if this is done the print will gain depth in the highlights especially, that is the print will appear softer.

Although Multigrade is intended for use with tungsten filament lamps it is possible to use it satisfactorily with a white cold cathode illumination in the enlarger. When this is done the exposures are rather more affected by the filters and the makers suggest factors of three times for the high-contrast filter and one-third for no filter, assuming the medium filter to be 1.

It is clear that the re-introduction of Multigrade adds a very useful weapon to the photographer's darkroom armoury. The suggestions which have been outlined for its use by the manufacturers are merely the beginning; there are many different ways in which this paper can be used to give better prints than are possible with normal papers and increase the speed and convenience with which any type of print may be made. This, however, is only a part of the story, for the quality of the prints obtained with it is outstandingly excellent. In our hands prints on Multigrade showed something of that subtle quality which characterises Plastika, and is not obtainable with straight bromide paper.

SIXPLEX DEVELOPING TANK

(Photax (London) Ltd., 70 Charlotte Street, London, W.1)

For those photographers who have need of a developing tank which is not adjustable for film size the Sixplex provides a neat and simple model which is specially intended for either 120 or 620 films. A small amount of positive adjustment is provided on the top spiral so that if there should be any small variation in the width of the film the tank can be adjusted to suit.

Vertical agitation of the reel is provided by two cam shaped protuberances moulded into the lower bearing of the reel which provide up and down movement only with anticlockwise rotation of the reel. The centre column of the reel has no cross members moulded internally so that a thermometer can be inserted right down to the bottom of the tank without difficulty. The agitator knob is combined with the clamping screw for the top spiral of the reel so that it cannot become lost, and a small funnel is also provided for filling the tank. No separate outlet for the solutions is provided, the filling and emptying are both done through the centre column, and the lid is held on to the tank body with a single turn-screw thread.

The Sixplex is a high quality tank in all respects, well designed and well made in black plastic. The price is 19s. 6d.

DIA BOOK SLIDE HOLDER

(J. J. Silber Ltd., 51/52 Avenue Chambers, Vernon Place, London, W.C.1)

As its name suggests this slide box is so constructed and finished that in its outward appearance it resembles a well bound book. It is actually constructed of wood but the spine, as it were, is covered in a dark maroon leather cloth with gold tooling. A white space is provided for the insertion of a " volume number ".

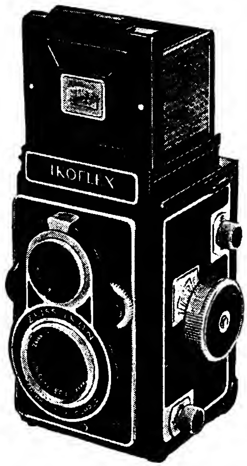
The quality of the construction is in every way excellent, all the joins are accurately dovetailed and the two halves of the box fit together accurately. This latter point is of some importance in view of the fact that it is essential to keep the contents as dust-free as possible. The outside dimensions of the box are 10 × 8½ × 2¼-ins. and spaces are provided for 100 slides. The slides are fitted into grooves in the separator strips and are thus securely held with no possibility of their rubbing together. An index card is provided.

The price of the Dia Book Holder is £1 14s. 6d.

ZEISS IKON IKOFLEX IIa

(Peeling and Komlosy, 181 Victoria Street, Dunstable, Bedfordshire)

To those photographers who prefer to use a twin-lens reflex the Ikoflex IIa will make an immediate appeal; it is a camera of high precision with all the features we have come to expect of the twin-lens reflex yet at the same time it is simple to manipulate.



The camera lens and the finder lens are both mounted on a common front panel which is moved in and out for focussing by a large diameter knob on the left hand side of the camera body. The whole of the focussing range of the lens, from 3½ feet to infinity is covered by turning this knob through only 90°. In spite of this small movement the knob is large enough for the individual scale markings on its circumference to be easily read. A depth-of-field scale is provided on the camera body so that this may be read off directly from the scaling on the knob.

The shutter speeds and lens iris are set from large milled discs which can be easily turned by virtue of their overhanging the edges of the lens panel at the centre between the two lenses. The reading of stop and shutter speed are made with the camera in its operating position in a small window above the finder lens.

The camera lens is an f/3.5 Zeiss-Opton Tessar of 75 mm. focal length and the finder lens is a Teronar anastigmat of similar aperture and focal length. The image on the ground glass of the finder is bright and evenly illuminated right out to the corners of the picture area due no doubt to the Fresnel type field lens fitted beneath the screen. A large diameter focussing magnifier can be swung into position inside the focussing hood for critically sharp work. This lens is large enough in diameter to enable the whole of the screen to be seen through it.

The shutter is an eight speed Synchro Compur which has speeds from 1 sec. up to 1/250 sec. and Brief time. Both M and X delay synchronisation is provided on the shutter and this is set by means of a small green setting lever below the camera lens. The shutter is automatically coupled to the film wind mechanism so that as the film is wound on the shutter is tensioned. The shutter release which is mounted at the top of the camera on the right-hand side of the focussing hood is interlocked with the film wind also so that double exposures can not be made.

Once the film has been loaded and wound on to figure 1 in the window in the base of the camera, winding is thereafter fully automatic. An automatic exposure counter is also fitted in the right hand side of the camera. A small red indicator appears in a window behind the shutter release when the film has been wound on and the camera is ready for the next exposure. Loading the camera is a perfectly straightforward operation and there is no possibility of mistakes with ordinary care in handling. The price of this fine camera is £69 15s. 0d. plus £22 13s. 5d. purchase tax.

HPS FLAT FILM

(Ilford Ltd., Ilford, London)

This sheet film is similar in speed, contrast, and colour sensitivity to the Ilford HPS plate which was introduced two years ago. The film base is the standard 8/1,000 in. thickness and is of the safety type with a dyed gelatine anti-halo backing which clears in development. The speed rating is B.S.37 degrees Log. or 400 Arith. to daylight, and 36 degrees Log. or 320 Arith. for tungsten lighting.

Average development times at 68 degrees F. in Ilford ID-2 developer are 6 mins. at a dilution of 1+2 and 12 mins. at 1+5. For Ilford PFP developer 4½ mins. at a dilution of 1+1 and 9 mins. at a dilution of 1+3 are recommended. Unlike the HPS plate the flat film may be developed in a fine grain developer such as ID-11 without any loss of emulsion speed, times between 11 mins. and 14 mins. will give negatives of satisfactory gradation. For maximum processing speed the use of Contrast FF developer is recommended and at a dilution of 1+4 and 1+9 the development times are 3 mins. and 6 mins. respectively.

This high-speed emulsion coated on film base is an addition which will be welcomed by all photographers who prefer this type of material to glass plates.

ROSS GAUGE PROJECTION LENSES

(Ross Ensign Ltd., Fulbourne Road, Walthamstow, London, E.17)

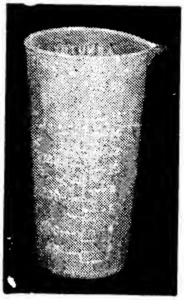
The use of a profile projector in engineering practice solves a difficult problem in an elegant fashion and this system is by now quite widely used. A profile projector enables the dimensions of a manufactured part to be checked against a standard drawing in spite of their possible complexity and the difficulty of providing such a check by other measuring methods. If the object is illuminated with parallel light and a suitable lens is used a magnified and accurate silhouette of the object, a screw thread or a gear tooth for example, can be projected on to a translucent screen on which the drawing can be placed. Errors of shape can thus be readily seen.

The lenses used for this type of work must obviously give a truly geometric representation of the object and be as free from distortion as is possible. These Ross lenses are available in three focal lengths, 9-inch, 4½-inch, and 2¼-inch, and when properly mounted they will accommodate cylindrical objects of diameters of 10, 3¾, and 1⅝-inches. Matched condenser lenses, necessary in view of the rather unusual conditions under which these objectives are used, are available. The price of the 9-in. lens is £90 0s. 0d., the 4½-in. £40 0s. 0d. and 2¼-in. £35 10s. 0d.

POLYTHENE MEASURE

(The Pullin Optical Co. Ltd., Pullin House, South Ealing Rd., London, W.5)

Along with thermometers the darkroom accessories with the highest fatality must surely be measures and graduates. Inevitably, it seems, laboratory glassware of this type is knocked against the sink or a tap sooner or later with the inevitable result. The advent of Polythene has resulted in a great improvement so far as measures are concerned, at least. This white translucent plastic is just transparent enough to make reading through the wall possible, sufficiently flexible to be indestructible by hard knocks and in addition it is inert to practically every chemical likely to be used by the photographer.

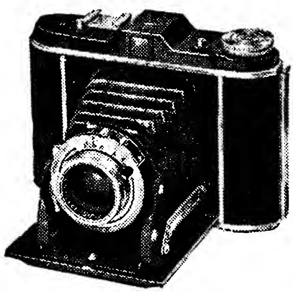


This Pullin measure is a good example of the use of this material in a measure. It is of sensible capacity—20 ounces—of a diameter such that it is easy to hold, and the graduations are large and easily visible even in quite low lighting levels. A moulded lip for pouring is provided and this is so designed that it gives a thin stream and pours cleanly. The price is 4s. 6d.

FRANKA SOLIDA JUNIOR CAMERA

(R. F. Hunter Ltd., Celfix House, 51 Gray's Inn Road, London, W.C.2)

The Solida Junior is an extremely good-looking camera which gives twelve pictures size $2\frac{1}{4}$-in. square on a 120 size roll film. The body of the camera is a metal pressing, which makes it extremely light, and this body is covered with an attractive ribbed black plastic. The trim is brightly chrome plated.



The lens of the camera is supported on its panel by a drop baseboard and is well strutted for rigidity. To open the camera for use a button on the top plate releases the baseboard which opens enough under spring pressure for it to be gripped. The panel is then swung down until it locks. To close the camera again a small metal strip which runs between the two support panels is pressed downward whereupon the lock is freed and the camera can be refolded.

The lens fitted is an f/3.5 Frankar coated anastigmat of 75-mm. focal length with front cell focussing. This objective is fitted into a three speed Vario shutter which has a Brief time setting and is synchronised for flashbulbs. A depth of field scale is marked on the front plate of the shutter.

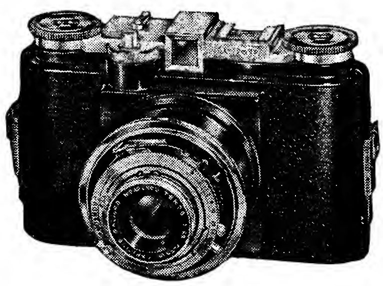
On the feed side the camera is fitted with no locating shafts for the film spool, instead a retractable spool chamber is fitted, a design which allows of easy and rapid loading. On the take-up side a similar chamber is fitted, but here, of course, the film spool has to be located on the shaft of the winding key. A safety cover is provided on the film indicator window.

On the top plate is mounted a black plastic moulding which carries at the centre the direct vision optical finder. To the right of this is the accessory shoe. Immediately before this shoe is fitted the body shutter release and matching this button on the opposite side of the finder is the baseboard release button. Altogether a nicely made and attractive camera. The price is £12 8s. 0d. plus £4 0s. 7d. purchase tax.

FERRANIA ASTOR CAMERA

(Neville Brown & Co. Ltd., 77 Newman Street, London, W.1)

The Ferrania Astor is a good example of a type of camera which at the present time is extremely popular; designed to give twelve exposures $2\frac{1}{4}$-in. square on a size 120 film but departing radically from the type of design which uses a bellows to link the lens panel and the camera body. The lens of the Astor is supported by a double telescopic tube of large diameter which, when it is desired to use the camera, is extended from the camera body by spring pressure. The camera body and the lens mounting tubes are all beautifully made alloy die-castings and the precision of the lens placing when extended would seem to be of a very high order. In addition the lens when in position is extremely rigid. The camera back is a sheet metal pressing and the outer surfaces of the body are covered with a tough grained black plastic.



The lens fitted to the Astor is an f/4.5 of 75 mm. focal length made by the well-known Italian optical manufacturers Officine Galileo, and is coated. The lens is fitted into a Prontor SV shutter which is speeded from 1 sec. to 1/300 sec. with a B setting. The shutter is synchronised for both M and X delay flash and has a delayed action release. A body release is fitted which is interlocked with the film wind. This interlock can be put out of action when necessary by simply turning a small lever mounted on the top plate of the camera, against spring pressure, and then operating the body release in the normal way. A red transparent indicator appears in the direct vision optical viewfinder as soon as the shutter has been released and until the film is wound on, thus neatly reminding the user that this step has been omitted.

An accessory shoe is fitted to the top plate of the camera and the film wind knob on the left hand side has its counterpart on the right which operates the release for the lens extension tubes when it is desired to use the camera. The top plate of the camera body is finished in matt chrome and the lens extension tube on black with chrome trim. A most attractive camera, well finished and accurately and precisely engineered. The price is £22 10s. 11d. plus £7 6s. 7d. purchase tax.

JOBO AUTOMAT 35 STANDARD DAYLIGHT DEVELOPING TANK

(Photo-Science Ltd., 10 North End Parade, W. Kensington, London, W.14)

Most daylight loading developing tanks work by the provision of a compartment outside the spiral reel from which the film in its cassette or spool is fed. This Jobo tank is novel in that the compartment which holds the cassette of exposed film is contained within the centre column of the spiral reel. The two halves of the spiral are separable and the cassette in a small chamber is placed between them; the leading end of the film is then made fast to a clip after threading through a sprocket which engages with the perforations. The spiral reel is then placed in the tank and the lid put on and locked. Rotation of the spiral from the outside then draws the film from the cassette since the sprocket is driven by engagement with a circular rack in the base of the tank and the clip which holds the end of the film is held stationary by a set of cams also moulded on the interior of the tank.

If it is not desired to develop the whole 36 exposure length of film the approximate number of exposures wound into the spiral can be counted and this length cut off. The cutting is performed automatically whether the whole length of film is developed or not, by a cylindrical knife in the centre column which is moved downward through the film by the action of sealing off the cassette chamber.

Aside from the convenience of being able to develop films without the need for a darkroom for tank loading, a tank such as this does mean that the film is untouched from the time it is packed at the factory until it is removed from the tank for drying. This can only be of help in keeping the films free from fingermarks, abrasions and dust, all of which are serious bugbears to the 35-mm. user.

The Jobo 35 Automat is beautifully made, the black plastic mouldings are accurate and intricate and the design is most ingenious. Filling and emptying the tank is reasonably rapid by virtue of the large space round the centre pillar and the large pouring lip. The price of this useful tank is £4 0s. 0d.

CIRCULAR PHOTOGRAPHIC DISH

(Ilford Ltd., Ilford, London)

This new circular dish, which is made of an unplasticised P.V.C. called Cobex, now replaces the previous dish of this type which was supplied in stainless steel. Ilford Limited state that the dish is especially suitable for D. and P. use, and indeed it may be employed by photo finishers as a fixing dish for prints, or for washing them.

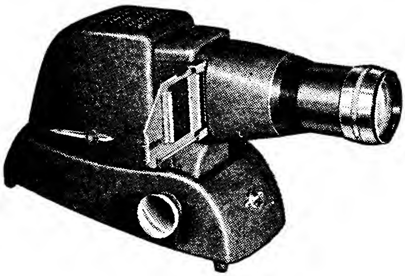
The Cobex is white, with a smooth glossy surface and its gauge is 3mm. That thickness makes the dish strong enough to carry about when almost full of liquid, and contrary to what one might expect from a semi-pliable material, the dish does not " twist " under the weight and the side pressure which has to be exerted to carry it. The sides are vertical and the top edge is finished with a large lip which makes the dish easy to carry. External diameter is 15½ in., internal diameter 14½ ins. depth 4 in., weight 1 lb. 5 oz.

Filled to the brim, the dish holds 2½ galls. When in use as a washer, siphoned to keep a 2-gall. water level, and with a rate of flow of 1 gall. per minute, it was found that the jet was ample to keep prints constantly moving, while a permanganate test (to colour the water) showed that a complete change was effected in five minutes. Being white, the dish is likely always to be kept clean. Price £2.

ALDIS SUPER SIX SLIDE PROJECTOR

(Neville Brown & Co. Ltd., 77 Newman Street, London, W.1)

In view of the popularity of the 2¼-in. square negative size and the increasing number of reversal colour films which are becoming available in rollfilm sizes the adoption of the 2¾-in. square standard size slide is a logical step. At the present time there are few projectors which are specifically intended for slides of this size compared to those available for 2×2-in. or 3¼×3¼-in. slides and so the advent of this Aldis projector is more than welcome.



The basic design of the Super Six is identical with the well-known range of projectors which has been available for some years, and in fact the rationalisation of components that this course permits is doubtless responsible for the reasonable price of the new model.

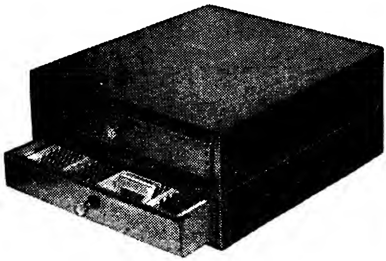
The condensers, of which there are three, are interchangeable to suit the projection lens used and a range of focal lengths to suit working conditions is available. To keep the size and weight to a minimum the condensers are all square. The high efficiency of the condenser system is evident from the extremely brilliant picture given by even the smaller of the two models, which uses a 300 watt lamp. The model of the Super Six, which uses a 750 watt lamp, has a cooling fan and can thus be used on alternating current mains only; the 300 watt model does not need forced draught cooling and can thus be used on either D.C. or A.C. mains. Both models have heat filters between the first and second condensers and there is no danger of overheating of the slides. The standard lens fitted to the projectors is an f/2.8 anastigmat of 6-in. focal length which is hard coated and gives a projected image of excellent definition.

The projector is finished in brown crackle enamel of most attractive appearance and is solidly and soundly made, the main chassis being a high grade die casting. Tilting of the projector on its own base is controlled by a large diameter knurled knob on the right hand side of the base. Carriers for 2 × 2-in. slides may be freely interchanged with the standard 2¾ × 2¾-in. carrier. The price of the 300 watt Super Six is £37 10s. 0d. and the 750 watt model costs £52 10s. 9d.

MINIATURE SLIDE UNIT STORAGE DRAWERS

(Pullin Optical Co. Ltd., Pullin House, South Ealing Rd., London, W.5)

Those photographers faced with the problem of storing an ever increasing number of 2 × 2-in. slides in a rational manner will approve of the design of these storage drawers. Two slightly different types of unit are made, a base and a top, the two fitting together with small locating blocks on the upper part which fit into rebates in the lower half. The top unit has a closed top whereas the lower unit has not, since it will be closed off by having its companion above it. When further expansion beyond 200 slides is desired then further bottom units can be placed beneath the one already in use, *ad infinitum*, each locating with its upper unit in turn.



The construction of these units is good; all the joints are well and accurately made and the outer surfaces are stained light brown and polished. The drawers hold the 100 slides in four rows of 25, and an interesting and sound innovation is the cutting of the slots into which the slides fit at an angle of about 60° to the vertical. Thus any name or number tabs affixed to the top of the mounts can be seen as soon as the drawer is opened and there is no need for any slide to be lifted up to find its number.

The price of either type of unit is £2 5s. 0d.

CHRISTEN 8-mm. CINE CAMERA

(Photo-Science Ltd., 10 North End Parade, W. Kensington, London, W.14)

This new addition to the range of double run 8-mm. cine cameras is of French manufacture; the design is straightforward and the camera is compact. The body measures $4\frac{1}{4} \times 5 \times 2$-in. and is finished in black crackle enamel with chrome trim. The lens fitted as standard is a Som Berthiot Cinor B of 12.5-mm. focal length and maximum aperture f/1.9. This lens is of fixed focus and has an iris working down to f/16. The lens is interchangeable and a long focus lens is also available. The shutter is not the guillotine type generally fitted to cameras of this type but is of the rotating sector pattern. Film speeds of 12, 16, 24, and 32 frames/sec. are provided and this adjustment is made by the rotation of a small knob on the right-hand side of the body.

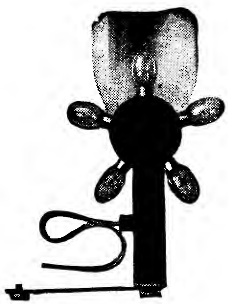
Mounted concentrically with the release button, which is on the front panel of the camera where it falls conveniently to the right forefinger, is a selector disc. This enables the camera to be locked, or set for single frame operation or continuous running as desired. The lock is of some importance since the release button is of the press-to-start, press-to-stop, type. Hence if the camera were packed in a bag, say, with the release not locked and the button accidentally depressed in carrying, the whole of 40 seconds running time of film would be run off and wasted if the motor were fully wound.

A film indicator of simple pattern is provided, and this has to be reset when the camera is loaded or reloaded. Depth-of-field tables for an f/1.9 lens and an exposure guide are provided on the front panel and the winding key respectively. The viewfinder is of the direct vision optical type contained within the camera body and an engraved frame indicating the field obtained with the long focus lens is visible on the front lens. The price of this camera is £33 19s. 0d. plus £11 0s. 8d.

PRESTON TURRET FLASHGUN

(Photax (London) Ltd., 70 Charlotte Street, London, W.1)

As can be seen from the illustration, this flashgun is of rather a novel design which should appeal to any photographer who wishes to make a number of flash shots in rapid succession with expendable bulbs.



Up to five bulbs with an A.S.C.C. base can be fitted into the revolving turret head so that when they are moved round into position before the reflector, contact is made with the base connection. The rotating turret is fitted with an indexing device so that location of each lamp in the firing position is simple and positive, thus being accomplished with the minimum delay.

The reflector is of simple pattern to allow the bulbs to be swung into position, but at the same time giving a well spread flood of light from the bulbs.

The electrical circuit is of the battery-capacitor type and the power supply is the standard 22½ volt deaf aid battery. The synchronising lead to the camera shutter is fitted with a standard Compur type plug and a non-reversible plug for connection to the battery case.

The outer casing of the body of the gun is covered in ribbed black plastic and all other metal parts are finished in polished chrome. A camera bracket is supplied. When completely dismantled the gun fits into a box 5 × 8 × 2-inches. The price of the Preston Turret Flashgun is £3 17s. 6d. plus £1 5s. 2d. purchase tax.

PRESTON FLASH TURRET

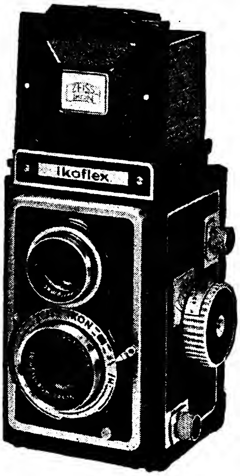
(Photax (London) Ltd., 70 Charlotte Street, London, W.1)

Incorporating basically the same idea as the Preston Turret Flashgun described above this Flash Turret is designed to be fitted to any flashgun which will accept bulbs with either an A.S.C.C. or E.S. cap. The turret head is simply fitted to the gun and the turret and reflector clipped on the head, the flashgun can then be used in exactly the same way as the Turret Flashgun. The price of the adapter is £2 5s. 0d. plus 14s. 7d. purchase tax.

ZEISS IKON IKOFLEX Ia

(Peeling and Komlosy, 181 Victoria Street, Dunstable, Bedfordshire)

The Ikoflex Ia is basically identical to the Model IIa but has been simplified in a number of the minor details. The camera lens is an f/3.5 coated Novar of 75 mm. focal length and the finder lens an f/3.5 coated Teronar of the same focal length. The shutter is a Prontor SV with eight speeds from 1 sec. to 1/300 sec. and Brief time setting. Shutter setting is not interlocked with the film wind as it is in the Model IIa but is done in the usual fashion with a cocking lever which projects from the shutter housing on the right hand side of the camera. Speed settings are adjusted with the usual milled setting ring of this type of shutter; it is turned with the forefinger of the left hand through a gap in the cover of the shutter. The figures for the speed settings are visible through a small window at the top of the casing. The lens iris is operated by a setting lever which swings through an arc beneath the shutter casing and the figures are visible through a window in the side of the casing.



Film wind and shutter release are interlocked and a small red indicator appears in a window beside the shutter release at the top of the camera when the film has been wound on and is ready for a further exposure. Once the film has been loaded and wound on to figure 1 by means of the red window in the base of the camera spacing of the exposures is automatic; an exposure counter is fitted into the right side of the camera body.

The image on the focussing screen is clear and bright right out to the corners and a large size focussing magnifier is fitted in the focussing hood. If desired the hood may be used as a direct vision sports finder by folding down the front plate and sighting through a rectangular hole on the back plate.

In its outward appearance the camera is most attractive with the body trimmed in black grained leather and the exposed metal parts matt chrome plated. The price of the Ikoflex Ia is £38 15s. 0d. plus £12 11s. 11d. purchase tax.

ROSS OPTICAL CEMENT No. 24

(Ross Ensign Ltd., Fulbourne Road, Walthamstow, London, E.17)

This cement is intended for use by lens manufacturers and indeed its widespread adoption by manufacturers in the field is a tribute to its superiority. The cement is not suitable for general use, since it needs to be baked for 36 hours at a temperature of 80°C. and has to be stored in a refrigerator and away from strong light.

The cement is applied with a glass rod to the centre of one of the components to be cemented and the second component pressed on.

Any excess around the edges of the components is scraped off with a knife. Each assembly is placed on a small piece of Cellophane. Jigs are used to hold the assemblies while baking and further pieces of Cellophane are stuck to the components where they would otherwise touch the jig.

The trays of assemblies are placed in a cold oven with forced air circulation and heated for 36 hours at 80°C. They are allowed to cool down before removal. A weight is placed on each large assembly before baking. With assemblies of smaller size than 20 mm. diameter weighting is not necessary.

After stripping the Cellophane the edges of the assembly are cleaned with toluene. The edges and the polished faces are finally cleaned with methylated spirit. The price of Ross Optical Cement No. 24 is £2 10s. 0d. per 4-oz. bottle.

CEBE ELECTRONIC FLASHGUN

(Neville Brown & Co. Ltd., 77 Newman Street, London, W.1)

The CeBe electronic flash unit is chiefly remarkable for its extremely small size and light weight: the power pack measures just $6\frac{1}{2} \times 3\frac{3}{4} \times 1\frac{3}{4}$-ins. and complete with batteries weighs 1 lb. 10 oz. When operated from batteries the power supply is six 30 volt deaf aid batteries, but as an alternative a mains unit can be fitted into the pack where it fits exactly into the space normally taken up by the batteries. With the mains unit the power pack is then simply connected to alternating current mains 200-250 volts.

The power pack is contained within a brown plastic moulded case one end of which is rounded so that the pack can be easily slipped into the pocket. The opposite end of the pack carries a useful table of stops for varying flash distances and film speeds.

The flash head is of simple construction with a highly polished reflector with a dimpled finish, six inches in diameter. The discharge tube which is of the standard low-voltage single-U type is mounted directly on the reflector and has a safety cover consisting of a disc of clear plastic which covers it completely. At the back of the reflector is a switch which operates the power pack and an indicator lamp which shows when the unit is ready to fire. The reflector is designed to be fitted to the standard accessory shoe of the camera and the synchronising lead is fitted with a Compur type plug. With a 32° BS film a flash factor of 70 as given by the exposure table on the power pack gave a nicely exposed negative. The price of the CeBe electronic flash unit is £16 19s. 7d. plus £5 10s. 5d. purchase tax. The mains unit costs £3 12s. 6d. plus £1 3s. 7d. purchase tax.

ZEISS IKON NETTAR 518/2 IH

(Peeling and Komlosy, 181 Victoria Street, Dunstable, Bedfordshire)

Over a period of many years the Nettar cameras of Zeiss Ikon have represented the best of the moderately priced folding roll film cameras. The current range is identical in design with those of earlier years and the 518/2 IH is a well-made camera of standard pattern for $2\frac{1}{4} \times 3\frac{1}{4}$-in. pictures on size 120 roll film.

The body of the camera is a beautifully made metal pressing covered in grained black leather and the top plate is finished in matt chrome. A direct vision finder is fitted in the centre of the top plate and this gives a bright image which is free from distortion. Immediately above this finder is fitted an accessory shoe.

The lens panel is supported by the drop baseboard which opens at the touch of a button on the top plate. The camera does not spring completely open under spring pressure, however, but opens only enough to enable the baseboard to be gripped and the camera then opened by hand. The use of strong spring to open a bellows type camera completely is to be deprecated since this will tend to draw the film into the picture aperture and cause it to bulge inwards from its proper position.

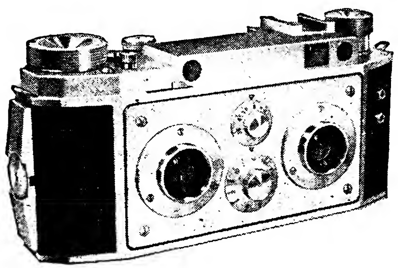
An f/4.5 coated Novar lens is fitted to the Nettar, of focal length 105 mm. This lens gives negatives of good definition and even illumination. The shutter is a Velio and has speeds from 1/10 sec. up to 1/200 sec. and Brief time setting. The shutter is synchronised for flash and, a point worth noting, has a screw-in cover to the cable release socket to prevent the ingress of dust. A depth-of-field table for the lens is provided on the front plate of the shutter and a body release is fitted. The release is interlocked with the film wind and a red indicator shows when the shutter is ready to fire after the film has been wound on.

All told the Nettar is a most elegant and attractive camera beautifully made and of good performance. The price is £13 3s. 6d. plus £4 5s. 7d. purchase tax.

VERASCOPE F.40 STEREOSCOPIC CAMERA

(Photo-Science Ltd., 10 North End Parade, W. Kensington, London, W.14)

The principal reason for the relatively small amount of stereoscopic work done on 35-mm. colour film in Britain is surely the lack of anything like a range of cameras for the job. This lack makes the advent of the Verascope F.40 extremely welcome. The camera has been made in France for some years and is indeed the latest of a long line of Verascopes made by the Jules Richard company.



The Verascope gives 12 pairs of pictures on a standard 20 exposure cassette of film, the single frames being 24 × 30-mm. in size. An interesting point about the camera is that should it be desired single frames may be exposed, and when used in this way as a monocular camera 24 single pictures are, of course, obtained.

The lenses are a matched pair of Berthiot anastigmats of 40-mm. focal length and f/3.5 maximum aperture. The lenses are coated and the two iris diaphragms are coupled to a single setting dial on the front plate of the camera. An eight speed shutter is fitted, with speeds from 1 sec. to 1/250 sec., and the settings are made from a second dial on the front plate. A body release is fitted in the usual position on the right of the camera top plate. The shutter is synchronised for both electronic flash and expendable bulbs. The film wind and shutter release are interlocked.

For focussing the two lenses move in and out on a common lens panel and this movement is controlled from a milled wheel. The built-in rangefinder is coupled to this focussing movement. Since the camera is slightly longer than the average single picture miniature the rangefinder base is rather longer than average thus giving increased accuracy at near focussing distances. The viewfinder is of the direct vision optical type.

The camera body is a light alloy die-casting covered in black leather and with a fine matt chrome trim. A standard type accessory shoe is provided on the top of the camera and the flash connection takes the form of a pair of sockets on the left hand side of the front of the camera body.

The Verascope F.40 is, as one would expect from this manufacturer, a thoroughly practical stereoscopic camera which gives excellent pictures and is convenient and easy to use. The price is £154 10s. 0d. plus £50 4s. 3d. purchase tax.

DRALOWID 8-mm. CINE PROJECTOR

(J. J. Silber Ltd., 51/52 Avenue Chambers, Vernon Place, London, W.C.1)

This projector embodies a number of interesting features, the most immediately obvious of which is evident from the illustration. Although it is not a sound projector, its outward appearance might lead one to believe that it is since the whole of the apparatus is totally enclosed. The outer casing is covered in attractive coloured leather cloth and a carrying handle is provided at the top; the projector is truly a portable machine since its total weight is 13-lbs.

All the operating controls are brought out to knobs which are recessed into the outer casing; focussing and framing are controlled from the two knobs on the top of the casing and the motor switch and speed control are at the front beneath the projection lens port.

The main body of the projector within the case is an alloy die-casting and the casing which covers the lens and its mount, and the transformer on the base, are black plastic mouldings. Plastic mouldings are also used for the feed and take-up spool supports fitted to the back of the projector casing entirely separate from the projector chassis. Threading is extremely simple and an inching knob is provided in an easily accessible position beneath the lens mount.

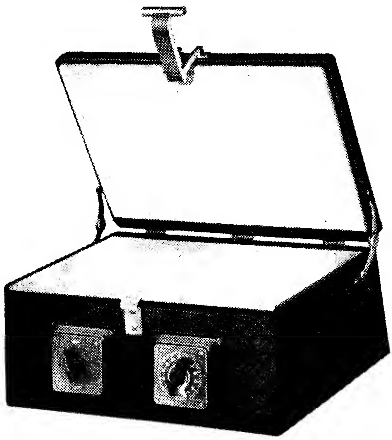
The projection lamp is a 15 volt, 60 watt type and in combination with the f/1.4 projection lens fitted gives a well illuminated picture up to a maximum size of about 4 feet wide. By virtue of the totally enclosed type of construction the projector is extremely silent in operation. The price of the Dralowid III projector is £29 19s. 6d.

DUOSTAT PRINTER AND PROCESSOR

(Kodak Limited, Kodak House, Kingsway, London, W.C.1)

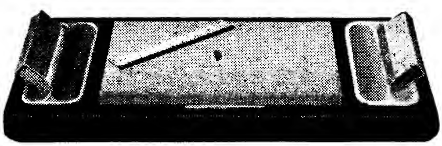
These two units together form a complete system of photographic document duplication which can be operated by office staff with no photographic knowledge.

The printer is a simple box-type unit which is fitted with eight 60-watt pearl lamps; by a rotary switch on the front of the printer these lamps can be switched into series or parallel circuits. This gives two levels of illumination, " High ", which is suited to papers such as Kodak Autopositive, and " Low " which is suitable for reflex papers. A time switch is also fitted to the front of the printer and this can be set for exposures up to 60 seconds. This switch can only be used on alternating current circuits and for those situations where it is required to use the printer on direct current an alternative model without the timer can be supplied.



Prints up to a size of 9 × 14-ins. can be made on this standard model printer; the dimensions of the unit when closed are $16\frac{1}{2} \times 13\frac{7}{8} \times 7\frac{1}{2}$-ins. The lid of the box forms a pressure platen which is covered with a sheet of Dunlopillo, faced with white sheeting, and it is held in the open position, so that the copy and the sensitive paper can be put into place, by two metal arms. The platen is fitted with a clamp designed so that larger documents than 9 × 14-ins. can be copied in two or more sections if desired. Two diffusers are fitted and these, together with the large number of lamps ensure even illumination over the whole of the picture area.

The Processor which goes with this simple printer is so designed that dishes of solutions are not used and the development and stabilisation of the prints is done under semi-dry conditions. The Processor consists of a tray of black plastic $27 \times 13\frac{3}{4} \times 1\frac{3}{4}$ ins. in the centre of which is recessed an absorbent porous block. At each side of the porous block is a removable plastic trough, one of which is coloured cream, the other red. The cream



trough is intended to hold the developer and the red the stabiliser, the quantity in each case being 2-3 ounces.

The exposed sheet of paper is placed emulsion side up on the porous block, held down by a rubber tipped stylus and the developer is applied from the trough with a sponge rubber applicator. After 20-30 seconds any excess developer is wiped to the edge of the paper where it is absorbed by the porous block. The stabiliser is then applied with its applicator and allowed to remain on the print for 30 seconds, then wiped to the edges of the print. The print can then be blotted off and is ready for handling. Processed in this way the prints have good stability under normal conditions of office storage.

The two solutions required are supplied in concentrated form and two graduated mixing bottles are supplied with the unit so that the necessary 1+2 dilution can be made easily. These bottles which hold 20 ounces of the working solutions are identified with cream and red neck bands.

Two models of processor are available, Model 9/14 which is suited for the processing of paper up to 9×14-ins. in size, and Model 14/18 which will handle paper up to 14×18-ins. in size. The prices of these units are respectively £18 0s. 0d. and £25 0s. 0d. The price of the Duostat Printer Model 9/14 is £39 0s. 0d. with the timer, and £25 10s. 0d. without the timer, for A.C. and D.C. supplies.

BA-CO BATTERY CAPACITOR FLASHGUN AND EXTENSION UNIT

(Neville Brown & Co., Ltd., 77 Newman Street, London, W.1)

The body of the Ba-Co flashgun is an elegant cream plastic moulding of rectangular section with a rounded upper end. The 5¼-in. reflector is fitted to this upper end by placing three slotted holes over studs in the moulding and giving a slight clockwise turn. The reflector is of the plain polished type.

A 22½-volt hearing aid battery provides the power supply and this is fitted into the battery case by removal of the front panel after slackening a captive screw at the base. The unit is designed to be fitted into the standard accessory shoe on the camera and a suitable foot is fitted at the base of the battery casing to fit. A synchronising lead with Compur plug and an open flash button are both fitted to the unit.

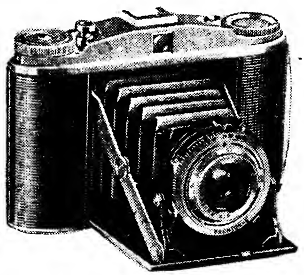
The extension unit comprises a 5¼-in. ribbed reflector in light alloy, highly polished and mounted on a neat spring clip with a universal joint. At the point where the upper side of the clip would bear against a polished surface, such as a table top, when in use, it is covered with a rubber sleeve. The clip has a maximum opening of 1⅛-ins. Twelve feet of extension cable are provided with the unit, and two small two-pin plugs fit into the extension unit and the main flash unit.

Both the main unit and the extension unit will accept flashbulbs with an A.S.C.C. base and clip-on diffusing screens are provided. The main unit is fitted with a bulb ejector. The price of the Ba-Co flashgun is £2 1s. 0d. plus 13s. 4d. purchase tax and the extension unit costs £1 9s. 0d. plus 9s. 6d. purchase tax.

ISOLETTE II CAMERA

(Agfa Ltd., Deer Park Road, Wimbledon Factory Estate, London, S.W.19)

This camera is available in three models, basically similar but having different lens and shutter equipment. With the exception of these components the three are in all other respects identical. The body of the camera is a metal pressing covered with a ribbed black plastic which is tough and virtually unscratchable. As is usual for cameras intended for twelve pictures 2¼-in. square on a 120 film, the drop baseboard which supports the lens on its panel swings downward when the camera is opened.



The lens panel and baseboard are rigidly supported and the lock is released so that the camera can be closed by pressing inwards on the hinges of the bracing struts. A direct vision finder is fitted in the top of the camera body with a body shutter release on the right and the camera opening button on the left. An accessory shoe is fitted immediately above the direct vision finder. The film wind knob is on the right of the body and this is matched on the left-hand side by a rotatable depth-of-field indicator.

The three models of the Isolette are fitted with either an Agnar anastigmat or an Apotar anastigmat lens, all of maximum aperture f/4.5 and 85-mm. focal length. These lenses are coated. The Agnar is fitted to the models with a three-speed Vario shutter and the four-speed Pronto. The Apotar lens is fitted to the model with an eight-speed Prontor S shutter. All three shutters have a Brief time setting and Time exposures can be made of any required duration by setting a small lever on the back of the top plate of the camera, behind the release, to T. When this is used the shutter is set to B but the body release button remains in a depressed condition until release by returning the lever. All the shutters are synchronised for flash and the body release is interlocked with the film wind. A small red indicator can be seen in a window beside the film wind knob until the film has been wound on ready for the next exposure.

The prices of the three models are; Agnar lens and Vario shutter £11 10s. 6d. plus £3 14s. 11d. purchase tax; Agnar lens and Pronto shutter £13 4s. 2d. plus £4 5s. 10d. purchase tax; Apotar lens and Prontor S shutter £15 15s. 8d. plus £5 2s. 7d. purchase tax.

SKYHOOK LIGHTING SET

(Ilford Ltd., Ilford, London)

This lightweight and versatile lighting unit is designed along rather novel lines which make it extremely useful when an easily transportable unit is required. In essence the unit consists of an extensible light alloy tube of 1-in. diameter which is fitted at each end with a circular cast plate. One of the plates is placed on the floor and the second is placed on the ceiling; the connecting tube is then extended until the whole forms a rigid assembly braced between floor and ceiling.

The reflector is attached to the vertical column on a double tube arm which is two feet long and a second identical arm is supplied to increase the extension to four feet. Alternatively the second arm may be used to support a second reflector. The two arms are a sliding fit on the main vertical tube and are held in their proper position simply by their own weight; they can be turned through 360°.

A 15-in. diameter reflector is fitted and this is intended for use with either No. 2 Photofloods or Series B lamps with an E.S. cap. Fourteen feet of three-core cable is supplied. The price of the Skyhook lighting unit complete with reflector is £6 0s. 0d. and the extra reflector costs £2 10s. 0d.

KOBOLD B.C. FLASH UNIT AND EXTENSIONS

(R. F. Hunter Ltd., Celfix House, 51 Gray's Inn Road, London, W.C.1)

In many ways this unit is the best designed and best finished we have seen. The components are all built into a cylindrical black plastic moulding some 1¼-ins. deep on the top of which is mounted the lamp-holder which is turned from solid metal. The casing for the battery and the capacitor takes the form of a three-inch length of light alloy tube which is fitted on to the moulded main chassis.

The Unit is designed to accept either A.S.C.C. or E.S. cap lamps and the adaptor for the former type fits neatly inside the larger socket. The bulbs are retained in place by a spring loaded ball which is effective on both types of cap; the bulb ejector consists of a knurled ring which with a slight twist retracts the spring pressure and allows the lower spring-loaded contact to force the bulb out of the socket.

A test lamp is fitted and the unit can be fired by a push button which is conveniently fitted for operation by the thumb of the right hand when the unit is held normally with the reflector pointing forward. A locking ring is fitted to the open flash release button to prevent accidental firing. Immediately beneath this button a battery cut-out switch lever is fitted.

Two two-pin sockets are mounted on the front of the unit to accept non-reversible plugs; one of these is for the shutter synchronising lead and the other for the cable to the extension unit.

The reflector is five and a half inches in diameter and is finished in highly polished chrome with a ripple surface. A good instance of the quality of the design is given by the slide which holds the reflector bracket so that it may be adjusted for height. This grips the bracket by means of two tiny spring loaded balls which hold it really firmly but at the same time enable it to be easily adjusted.

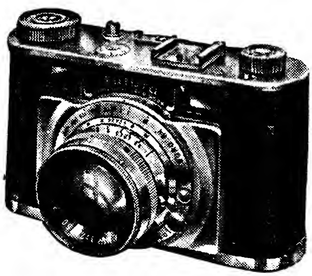
The lower casing is removable for the insertion of the 22½-volt deaf-aid battery by giving it a turn and then pulling it downwards. The finish of the battery casing is fine black crackle.

The extension units have an identical reflector and bulb holder to the main unit but, of course, the main body is much smaller since there is no need for the battery. The actual dimensions are 1¼-in. diameter by 3½-in. long and the whole of the casing is machined from light alloy with a black crackle finish. A tripod bush is provided in the base of the unit. Six and a half feet of light connecting cable with a two-pin plug at each end for inter-connection is supplied. The price of the Kobold B.C. Flashgun is £5 11s. 3d. plus £1 16s. 2d. purchase tax. Price of the extension unit is £3 4s. 0d. plus £1 0s. 10d. purchase tax.

FUTURA CAMERA

(Photo-Science Ltd., 10 North End Parade, W. Kensington, London, W.14)

The Futura is a beautifully made miniature camera which is designed to accept interchangeable lenses; it can thus be conveniently classified in the group of cameras which for lack of a better description are called " precision " miniatures. The standard camera is fitted with a Compur Rapid shutter which is mounted within the body of the camera and not between the elements of the lens as is more generally the rule. The film wind and the shutter setting are interlocked and the rangefinder is coupled to the lens focussing.



The body of the camera is a light alloy die-casting which is covered on the outside by a grained finish plastic. The lens mounting panel and the top and bottom plates of the camera body are finished in matt chrome.

The standard lens fitted to the camera is an f/2.8 coated Elor of 50 mm. focal length. In focussing the whole of the lens is moved back and forward by rotating the lens mount with the forefinger. The rangefinder and the viewfinder window are combined and the rangefinder is particularly easy to use. A depth of field scale is engraved on the front panel of the lens mount.

For loading the back of the camera is completely removable and the finish of the interior of the camera is excellent in every way. An exposure counter is provided on the top plate of the body and the body release is at the back of the top plate on the right hand side of the camera. An accessory shoe is provided. A wide range of accessories is made for use with the Futura and altogether the camera is a well designed and constructed piece of equipment. The price of the standard model with f/2.8 Elor lens in a Compur Rapid shutter is £48 0s. 0d. plus £15 12s. 0d. purchase tax.

DENT PROCESS TIMER

(Johnsons of Hendon Ltd., Hendon Way, London, N.W.4)

Those darkroom workers who need a timer of high accuracy and robust construction will find in this Dent model all that they need. The size of the circle swept by the seconds hand is 5½-ins. and the overall diameter of the clock is 7¼-ins. All the figures and the tips of the seconds and minute hands are luminescent and are large enough to be easily seen in total darkness. The accuracy is ± 2 seconds per hour.

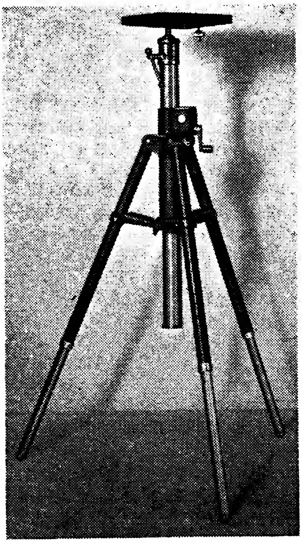
The most notable thing about this timer is the extremely strong construction, the casing is heavy gauge steel sheet and the back is a solid brass casting. A thick glass bezel is fitted and this is retained in place with a brass ring.

The stop and start lever is fitted on the right hand side of the body and a resetting tab is provided at the bottom of the casing. The clock can be hung from a slotted hole in a bracket provided at the top of the casing. The price of the Dent Timer is £8 15s. 0d.

METAL COMPACT STAND MODEL 2

(Kodak Limited, Kodak House, Kingsway, London, W.C.1)

This stand is a slightly modified version of the Compact Stand made by this company and is specifically designed to suit the professional photographer using a camera up to half-plate in size. When closed the stand occupies a space of some 28 × 7 × 5-ins.; when open it provides an extremely solid tripod which will extend from a height of 28-ins. to 57½-ins.



As can be seen from the illustration the stand is built up on a short length of steel tube of 2-in. diameter. This tube provides the supports for the three tripod legs and also carries the centre pillar which gives 13-ins. of the total 29½-ins. extension. When the tripod is in its operating position the spread of the legs is not adjustable since they are locked solidly to the centre section by three bracing members. The trunnions into which the tops of the legs fit are part of the solid die-cast unit at the top of this centre section tube. The legs are in two sections and the lower can be set and locked at any desired height with a clockwise twist.

The centre column is raised and lowered by the rotation of a small handle at the top of the main tube. This operates by the rotation of a ball toothed wheel which engages with holes in the column; the column is locked by a screw which operates a clamp in the main tube.

The camera platform is 7 × 7½-ins. in size and is faced with a rubber material having raised dimples on its surface. The camera is held in place with a captive ¼-in. Whitworth bolt which runs in a slot so that the camera can be centralised. The platform is mounted on a large ball-and-socket head which is locked with a small tommy bar. The maximum angle of tilt is 45° except in one position where it can be turned through 90° to give a vertical lens axis to the camera. The stand is finished in black crackle enamel, matt and bright chrome, and the price is £25 0s. 0d.

BILLY I CAMERA

(Agfa Ltd., Deer Park Road, Wimbledon Factory Estate, London, S.W.19)

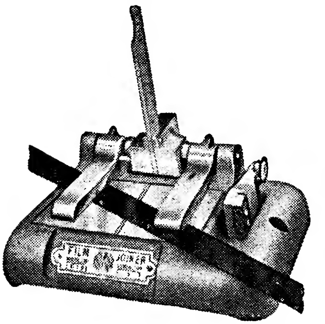
The Billy is a good-looking, soundly made but reasonably priced folding roll-film camera which would be ideal for the photographer who desires to move on from the box camera stage. The f/6.3 Agnar lens has the extra reserve of speed which enormously increases the utility of such a camera as this and in addition to providing contact prints large enough for easy examination it provides a negative crisp enough for enlargement. The lens is coated and focussing is by rotation of the front cell. The shutter is a three-speed Vario with Brief time setting and it is also synchronised for flash. A body shutter release in the true sense of the term is not fitted but the release is fitted just inside the drop baseboard close up to the body of the camera by the hinge. This fitting has the great advantage that it simplifies the construction of the camera (and hence contributes to the moderate cost) but at the same time it is, in use, little if any different from a body release fitted in the conventional position. It is certainly no more difficult to release the shutter on the Billy than it is say on its companion in the Agfa range, the Record.

The body of the camera is a sturdy and well finished metal pressing which is covered in ribbed black plastic. A simple direct vision optical finder is fitted. The price of the Billy I with f/6.3 lens is £8 1s. 10d. plus £2 12s. 8d. purchase tax.

PREMIER UNIVERSAL AND DIAGONAL FILM JOINERS

(Robert Rigby Ltd., Premier Works, Northington Street, London, W.C.1)

Although these two narrow gauge film splicers make rather different types of join the mode in which they are used is identical and in addition somewhat unusual. As can be seen from the illustration of the model which makes a diagonal splice the basis of the joiners is a solid casting the operating surface of which is ground dead true and flat. The Universal model carries set in this surface two sets of pins, those nearest to the front of the splicer being intended for locating 8 and 16-mm. film and those at the back for 9.5-mm. film. The Diagonal model carries only one set of register pins, for 16-mm., since this is the only size in which this splice is used.



Also in the illustration will be seen the two flaps which hold the two strips of film to be joined in place and a centre bar which has been swung up away from the films. To use the splicer the film is placed on the right hand side first, located on its pins, the centre bar is then slid to the limit of its travel to the right and lowered on to the film. The rotary cutter which can be seen lying in its holder on the right of the illustration is then used to cut off the free end of the film on the left of the centre bar. This piece of film is then laid on one side until the next steps have been completed.

The left-hand end of the film is next laid in place and the centre bar moved over to the extreme left of its travel. The free end is not however cut from this part of the film until the emulsion has been scraped from it with the dry scraper which is provided at the opposite end of the rotary cutter. When this has been done the centre bar is lifted and moved over to the right end of its travel and the free end of film cut off with the rotary cutter. All these cutting operations are correctly located for position by two channels cut in the casting of the splicer body.

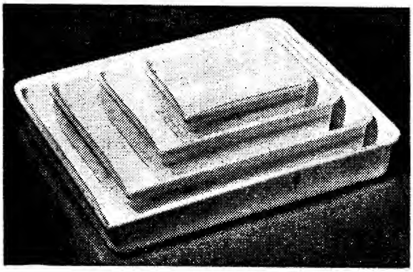
The right hand end of the film which was previously laid on one side is then replaced on its pins and the flap lowered on to it to hold it in place. The right end is then lifted up, the cement applied to the scraped surface of the left end and the right end quickly lowered onto it. The centre bar is then allowed to drop on to the join under its spring pressure and the splice is allowed to set.

From this condensed description it will be seen that the method of using these splicers differs radically from those in common use. Having tested them there is no doubt that they make excellent joins rapidly and easily, and the finish and workmanship are in every way to be commended. The price of the Universal Joiner is £4 17s. 6d. and that of the Diagonal Joiner £4 17s. 6d.

OPAL PERSPEX DEVELOPING DISHES

(The Pullin Optical Co., Ltd., Pullin House, South Ealing Rd., London, W.5)

These developing dishes are available in a range of sizes from 3¼ × 4¼-in. up to 10 × 8-in., including 6½ × 4¾-in. and 8½ × 6½-in. Being made from white Perspex they are easy to keep clean and are easily seen under a safe-light. Three ribs are moulded into the bottom of the dish, hollow on the inside of the dish, so that a large quantity of solution is not required before the plate, film or paper is covered with solution.



Perspex would seem to be an ideal material for the manufacture of developing dishes since it is quite inert to processing solutions and possesses enough stiffness to make the dishes easily carried without too much " whip " even in the larger sizes.

These dishes are well made, of adequate depth and with a good pouring lip. The price of the 4¼ × 3¼-in. size is 5s. 6d.; the 6½ × 4¾-in. size 7s. 6d.; the 8½ × 6½-in. size 9s. 9d.; and the 10 × 8-in. size 12s. 6d.

8-in. F/8 HIGH RESOLUTION LUSTRAR SERIES II

(Wray (Optical Works) Ltd., Ashgrove Road, Bromley, Kent)

In its original form this lens was reviewed in the *British Journal Photographic Almanac* for 1951; in its new form it retains all the virtues of the lens as there described—excellent definition and very low flare—and includes some other advantages in addition.

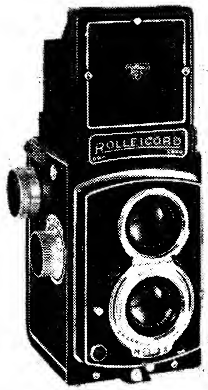
The lens has been recomputed and it now has a particularly high stability of correction with change of conjugates. This means that the high performance over a half plate in the camera is maintained and the lens may be used with equally good results for enlarging.

This great range has been achieved with no sacrifice of definition or colour correction and the lens is now a versatile all-purpose objective for high-grade still photography where the recording of fine detail is all-important.

ROLLEICORD IV

(R. F. Hunter Ltd., Celfix House, 51 Gray's Inn Road, London, W.C.1)

The Rolleicord IV is the latest model of a camera which has come to be as highly thought of by practical photographers as is its companion the Rolleiflex. As in earlier models not quite all the features of the Rolleiflex are incorporated but in many respects it is identical with the Rolleiflex 2.8C. The most notable similarities are the deep baffles fitted internally to reduce the effect of stray light, the adjustable film pressure plate for either 35-mm. film in the Rolleikin back or 120 rollfilm, and both M and X delay flash synchronisation.



The outward form of the camera is, of course, little changed. The film is wound by a large diameter knob and loading the camera is extremely simple. The film is wound on until the double-headed arrow printed on the backing paper is aligned with two red dots at the sides of the film aperture. The back of the camera is then closed and the film wound on until it stops. The film is then correctly placed for the first exposure. The shutter is not wound automatically with the film but has to be tensioned by pushing the shutter release lever beneath the lens mount through an arc to the right. The same lever operates the shutter when pushed in the opposite direction.

The film wind and the shutter release are interlocked but this interlock can be broken, should a flash bulb misfire or a double exposure actually be needed, by pressing a release button on the front panel of the camera. This enables the shutter to be reset without winding on the film.

The synchroniser delay is set by setting a small knob immediately beneath the camera lens to either M or X in a small slot in the casing which covers the shutter.

The shutter speeds and lens stop settings are adjusted by the movement of two levers, one on either side of the shutter casing. The actual settings can be seen in two windows one on either side of the shutter casing at the top where it narrows to meet the mount of the finder lens.

The camera lens fitted to the Rolleicord IV is an f/3.5 Schneider Xenar of the standard focal length for this size negative of 75-mm. This lens is well known as a high grade anastigmat and has indeed been used for some models of the Rolleiflex Automat since the end of the war.

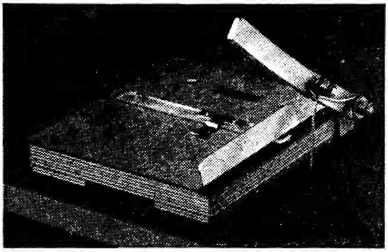
The adjustable pressure pad which is fitted into the camera back obviates the need for a special back for 35-mm. film and the minimum number of extras are now needed for this conversion. The focussing hood carries a focussing magnifier and can also be used as a sports finder by folding down the front panel.

It seems hardly necessary to say that the finish of this camera is excellent, the quality of the workmanship is as always beyond reproach. All the controls move smoothly and the camera is a delight to handle. The price had not been fixed at the time of going to press.

AUTO-VELOX TRIMMER

(Kodak Limited, Kodak House, Kingsway, London, W.C.1)

This piece of equipment is a new addition to the range which is specifically designed for use with the Auto-Velox Printer. The trimmer is a foot-operated model and thus leaves the operator with both hands free to manipulate the strip of prints or negatives.



The base of the trimmer is made from wood and is faced with Formica sheeting—a tough and hard-wearing plastic material. The cutting blade is 7-ins. long and is held normally open by a strong spring. The blade is connected to the foot treadle by a steel cable, and a metal guard strip fitted along the lower cutting edge of the base safeguards the fingers of the operator.

The foot-treadle is made from wood and faced with rubber. A metal hinge is screwed to the floor so that the treadle is securely anchored.

An indicator finger is fitted to a guide on the base of the trimmer and this is set so that when it lies across the centre of a white division between pictures on the strip of prints the latter is in the correct position for trimming. The price of the Auto-Velox Trimmer is £4 4s. 0d.

STELLIRA TRIPOD SCREEN

(Actina Ltd., 10 Dane Street, High Holborn, London, W.C.1)

Arranging some support for a projection screen is often quite a problem; in the case of this new Stellira screen however the problem is neatly solved by the provision of a supporting stand which carries the screen. The stand and the tube in which the screen proper is rolled for transport are of all metal construction, principally light alloy.

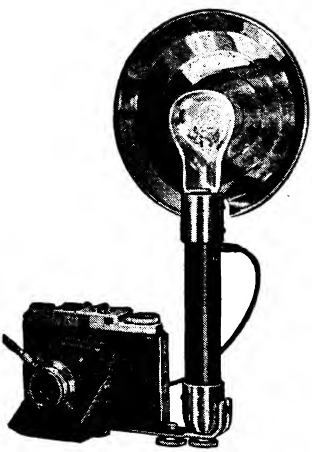
The main strut of the stand is a tube of triangular cross-section which is fitted at its lower end with three legs fitted with rubber feet. For carrying, the legs fold in close to the main tube. Sliding on this main supporting column is a heavy gauge bracket which can be locked in any desired position; this bracket carries the screen in its metal covering tube pivoted halfway along its length. For transport, the tube is swung parallel to the main strut; for use it is placed at right angles. Also sliding within the main strut is a rod provided with a hook at its upper end, this rod when extended provides the top support for the screen when it is withdrawn from its tube. The screen is carried in a roller which is spring loaded fairly heavily so that it is held taut in use.

The screen centre can be adjusted in height from the floor from approximately 3-ft. to 5-ft. 6-ins. When folded and ready for transport the 50 × 40-in. size screen occupies a space of 58 × 6 × 3½-ins. In addition to the 50 × 40 size which is intended for cine work a square screen size 50 × 50-ins. is available for still projection. The prices of these screens in white are £12 15s. 0d. and £14 7s. 6d. respectively; and beaded £15 0s. 0d. and £16 15s. 0d. respectively.

ZEISS IKON IKOBLITZ III FLASHGUN

(Peeling and Komlosy, 181 Victoria Street, Dunstable, Bedfordshire)

This gun is of the battery-capacitor type and uses a 30 volt deaf-aid battery as its power supply. The quality of the workmanship which it displays is of a very high order; for example the lamp socket and the base cap on the body of the gun have been left in their natural turned finish but this is so fine that it closely resembles matt chrome.



To insert the battery, the bottom cap, which has the camera bracket fixed to it with a captive bolt, is removed by giving it a slight turn, then pulling it off. The battery is then slipped into place and the cap replaced. At the top of the body are two-pin sockets, one of which is used for the synchronising lead to the camera shutter; the second socket can be used to connect up an extension flash should this be required.

The gun is designed to take flashbulbs with an E.S. cap but an adapter can be obtained so that lamps with A.S.C.C. caps can also be used.

The reflector is 6¾-in. in diameter, is very shallow and highly polished. This shape of reflector gives a wide spread of light of even intensity.

When not in use the camera bracket can be swung upwards so that it lies parallel to the body of the gun and with the reflector removed the battery case and camera bracket can be easily slippped into an overcoat pocket. The camera bracket is covered with a strip of ribbed rubber on the side at which it bears against the camera and the two thumb screws which are used to hold the camera in place have a tiny button of rubber inset in their end where they butt against the bottom of the tripod bush in the camera. The price of this unit is £5 12s. 6d. plus £1 16s. 7d. purchase tax.

WATER CIRCULATING ATTACHMENT

(Ilford Ltd., Ilford, London)

This neat accessory is designed to give a reasonably efficient circulation of the water flowing into a standard photographic dish when this is used for washing purposes. The attachment consists of a short length of brass tube, chrome plated, with one end slightly flattened and bent at an angle to the main length. The opposite end of the tube is ribbed to grip a rubber tube from the water supply.

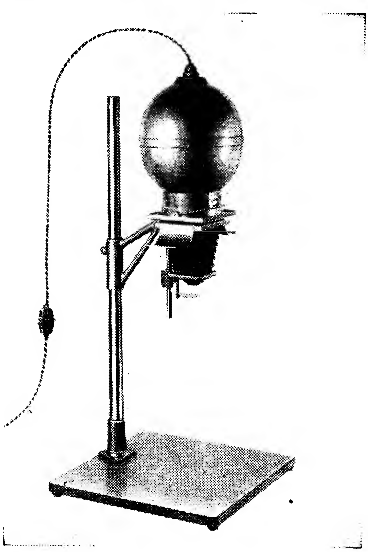
The whole device is attached to the side of a dish by a small clip and a set screw. The clip can be fitted on to any dish which does not have a lip wider then ⅝-in.

With careful adjustment of the water pressure by the supply tap the attachment can be made to give good circulation within the dish and a consequent increase in washing efficiency. The price of the attachment is 4s. 0d.

WASP MODEL 120 ENLARGER

(R. F. Hunter Ltd., Celfix House, 51 Gray's Inn Road, London, W.C.1)

The Wasp 120 is a new addition to this well known range of equipment which like its predecessors is a well made job, nicely finished and reasonably priced. In all respects, from the base up it conforms with standard practice; the base is a 15 × 15-in. laminated board on rubber feet, the 30-in. column is firmly anchored to this base with a stout die-cast flange. The support bracket for the enlarger head is again a die-casting of simple form and this is clamped to the column with a 1¾-in. diameter head clamping screw.



The head unit consists of a backplate which is fixed to the bracket and carries the single rod which forms the monorail support for the lens panel. Both the back plate and the lens panel are die-castings and are accurately machined so that they run true and square; the two are linked by a bellows with a maximum extension of 6½-in. Focussing is by spring loaded friction wheel running in a deep machined slot in the support rod.

An interchangeable type lens panel is fitted to the focussing front and a red plastic filter is supported a little distance in front of the lens on its own support pillar.

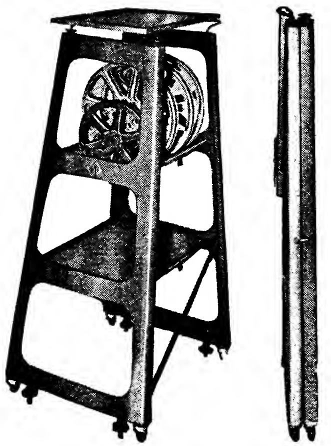
The lamphouse is a stout metal spinning of roughly spherical shape finished in matt white inside. The single condenser is held in place by a flange inside the main casting and the lower end of the lamphouse fits into this casting on a similar flange of slightly larger diameter.

The negative carrier is of the double glass type which is carried by a metal holder. This holder is fitted with strip negative supports at either side. The enlarger is attractively finished in bronze hammer finish enamel and the price is £13 10s. 0d. plus £4 7s. 9d. purchase tax.

PREMIER TROLLEY STAND

(Robert Rigby Ltd., Premier Works, Northington Street, London, W.C.1)

This projector stand is especially designed so that it can be moved from place to place with ease yet at the same time it provides a platform of the utmost rigidity. The stand is made from heavy gauge sheet metal and when not in use folds flat into an extremely small compass. In addition to the top platform on which the projector is placed two extra shelves are provided below for the storage of spare reels, in the case of the upper one which is suitably slotted, and electrical accessories such as the transformer in the case of the lower one. The projector platform is 21 × 13-ins. in size and can be adjusted for angle through 7° on either side of the horizontal.



Four ball-bearing castors are fitted to the base of the stand together with four adjustable screw feet. When the equipment is located at its correct position the screw feet can then be used to take the weight off the castors and the stand can also be levelled regardless of any uneveness of the floor. The screw feet are rounded to prevent indentations and damage to floors.

The cross bracing of the stand makes it perfectly rigid and in spite of its lightness and portability it provides a projector platform of great steadiness. The height of the top platform from the floor is 4-ft. 2-ins. and the stand is finished in an attractive anodised enamel. The price is £14 14s. 0d.

ROLLEIFLASH EXTENSION UNIT

(R. F. Hunter Ltd., Celfix House, 51 Gray's Inn Road, London W.C.1)

This extension unit is basically the standard Rolleiflash without the flexible bracket and bayonet ring or the retracting synchronising lead. The reflector size is the same as the main unit, 5-in., with the same bright chrome and ripple clear lacquer internal finish. The body of the extension unit contains no battery, the power supply being the battery in the main unit. Two neat co-axial sockets are fitted one on either side of the triangular body. The first of these is for the connection to the main Rolleiflash unit and the second is provided so that a second extension unit may be connected to the first. The socket is identical with that provided on the Rolleiflash and the length of connecting cable supplied, some 6-ft. 6-in. long, has a similar plug at each end so that there is no need for correct orientation.

A tripod socket is provided at the base of the body and a small button on the top operates the bulb ejector. The price of the Rolleiflash extension unit is £4 7s. 6d. plus £1 1s. 8d. purchase tax.

AGFA SILETTE CAMERA

(Agfa Ltd., Deer Park Road, Wimbledon Factory Estate, London, S.W.19)

This new Agfa camera is a 35-mm. miniature which is in some ways reminiscent of the several models of the Agfa Karat which were available both before and for a period after the war. It reminds one of the pre-war Karat because of its extremely moderate price and the excellent quality, whereas it is in its construction that it most resembles the post-war Karat 36.

Two models of the Silette are available, both with the same Agfa Apotar f/3.5 lens. This lens has a focal length of 45 mm. and is coated; focussing is by front cell. The camera can be obtained with this lens fitted into either a Pronto four-speed shutter or a Prontor S eight-speed shutter. Both these shutters have Brief time settings and are synchronised for flash.

The shutter and the film are both wound by a thumb lever mounted on the right hand end of the camera body, which turns through 180°. By this means the camera can be operated extremely rapidly should it be so desired, and sequences of pictures, where too high a frequency is not desired, are easily possible.

The camera body is a beautifully finished alloy die-casting and the exterior is covered in black grain leather with a matt chrome trim. The lenses are not interchangeable and although the focal length is only a shade less than that considered normal for a 24 × 36-mm. frame the appearance of the camera is well proportioned even though the lens is not fitted in a collapsing mount. A direct vision optical finder is fitted directly above the lens in the top plate of the camera body and an accessory shoe is also provided. The exposure counter is mounted within the circular disc of the shutter and film wind lever and is stepped on by one exposure every time the lever is operated. The rewind knob at the opposite end of the camera body also functions as a film type and film speed reminder. The body release button, which is of generous size, is mounted close to the film wind lever on the right of the camera. In every way a most attractive and elegant camera, the Silette should be extremely popular, as popular in fact as its distinguished forebears. The price with a Pronto four-speed shutter is £13 18s. 0d. plus £4 10s. 4d. purchase tax. The price with the eight-speed Prontor S shutter is £16 12s. 0d. plus £5 7s. 11d. purchase tax.

10-in. F/3.5 PORTRAIT ANASTIGMAT

(J. H. Dallmeyer Ltd., Church End Works, Willesden, London, N.W.10)

These portrait anastigmats are available in a range of four focal lengths, 9, 10, 12 and 14-ins., and all are four element anastigmats. They can if desired be supplied in a special mount which enables a variable amount of diffusion to be introduced, the amount of diffusion is controlled by rotation of the front cell.

In the normal position the definition given by the lens is all that one would expect and the lens should prove extremely suitable for a wide range of work in the portrait studio.

The mount of the lens is beautifully finished in matt chrome and black and a chrome mounting flange is provided. The price of the lens without the diffusion mount ranges from £29 10s. 0d. for the shortest focal length to £75 0s. 0d. for the longest. In the variable diffusion mount the price ranges from £34 10s. 0d. to £83 0s. 0d.

BOOMLITE LIGHTING UNIT

(Johnsons of Hendon Ltd., Hendon Way, London, N.W.4)

This unit consists of a lightweight collapsible stand, which may if desired be fitted with tyred castors, which supports a light counter-balanced boom. The boom can be used to carry up to three reflectors at its outer end. Including the flexible gooseneck fitting the maximum extension of the boom fitting is 5-ft. and the stand proper can be elevated to a height of 8-ft.

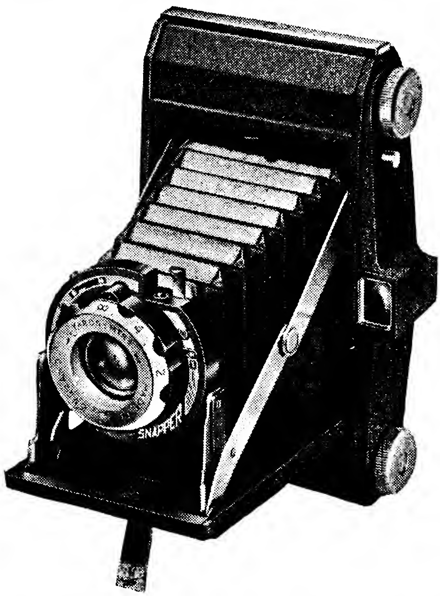
The stand which supports the unit is built from light steel strip and finished in grey polychrome enamel; the castors are of large size and the whole unit can be wheeled from place to place in the studio with ease.

The vertical extending column and the boom are both finished in bright chrome; altogether a most useful and versatile lighting unit. The price of the unit without the wheel base is £9 15s. 0d. and with the wheelbase is £12 10s. 0d.

ENSIGN SNAPPER CAMERA

(Ross Ensign Ltd., Fulbourne Road, Walthamstow, London, E.17)

The Snapper is a simple and moderately priced folding camera which takes eight 2¼ × 3¼-in. pictures on a 620 roll film. The body of the camera is a light alloy diecasting which is finished in grey wrinkle enamel and the back and lens baseboard are metal pressings.



Although the objective is a simple lens of f/11 aperture this is fitted in a focussing mount which covers the range of two yards to infinity by rotation through 90°. The shutter housing in which the lens is fitted is a black plastic moulding, and this is fixed to the supporting struts which link the drop baseboard and the body of the camera.

The shutter is of the everset type and can be set to give either an instantaneous exposure of 1/30 sec. or time exposures. A flash synchronising socket is fitted and the shutter is designed to be used with expendable flashbulbs. The shutter release is of the press button type and a cable release socket is provided alongside it on the shutter housing.

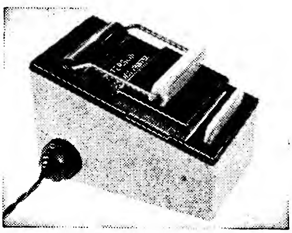
A direct vision optical finder is moulded integrally with the camera body and it is interesting to note that the eye lens of this finder is of generous size, far larger than those which are generally fitted to finders of this type. This makes the finder noticeably more comfortable in use when compared to a standard pattern with a very tiny eye aperture. At the same time there would appear to be no loss of accuracy since it is at once obvious if the eye is not centrally placed and framing not exact.

A tripod bush is fitted in the centre of the drop baseboard in addition to that at the end of the camera body for horizontal framing. The price of the Snapper is £4 3s. 6d. plus £1 7s. 2d. purchase tax.

PATERSON CONTACT PRINTER

(R. F. Hunter Ltd., Celfix House, 51 Gray's Inn Road, London, W.C.1)

This contact printer is rather novel in that it is made completely of plastic mouldings. The main body consists of a box in translucent yellow with a sloping top which is black. Thus the printer will also act as a safelight since the yellow body passes quite enough light for working and of a safe colour for contact paper. The front of the lamp compartment is divided into two horizontally, the upper portion being covered with a strip of amber glass and the lower part open so that the light from the lamp can reach the printing aperture after reflection from the white interior of the box. The lower aperture is normally masked by a metal shutter which is pivoted so that it can be swung to cover the strip of amber glass at will. The shutter is operated by a yellow plastic thumb bar which projects from the top of the printer just beneath the pressure pad. Thus the one lamp at the back of the printer illuminates the printing aperture either through the amber filter, or directly with white light when the thumb bar is depressed.



The printer will take negative sizes up to 3½ × 2½-ins. and a set of translucent red masks is provided for smaller sizes. The glass on which the negative is laid for printing is a sheet of flashed opal and the pressure pad is covered with a sheet of thick sponge. The price of the Paterson Contact printer is £1 15s. 0d.

FLEET VIEWFINDER

(Neville Brown & Co., Ltd., 77 Newman Street, London, W.1)

There are many occasions when a separate viewfinder is a useful aid. It can be used for deciding on a suitable framing for a picture without the need for opening up the camera or taking it from its case. This Fleet finder has the additional advantage that it incorporates a light blue filter which assists in some degree the estimation of a monochrome rendering of the scene.

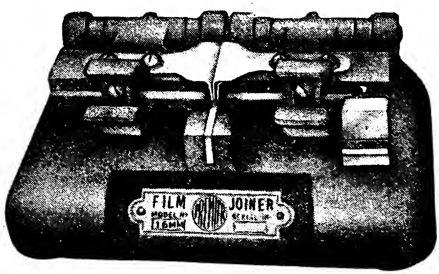
The finder is specifically intended for use with cameras using the popular 2¼ × 3¼-in. negative size and having lenses of focal length between 10 and 15 cm. It takes the form of a direct vision optical finder mounted in a tubular casing some 2¾-ins. long by 1-in. square section. Thus it will be seen that the finder can be easily slipped into the pocket. Should it be desired to fit the finder on to the camera a small sprung clip is mounted on its underside.

The finish of the useful accessory is black crackle enamel with chromed mounts for the lenses at each end. The price is £1 2s. 5d. plus 7s. 4d. purchase tax.

PREMIER DE LUXE FILM JOINER

(Robert Rigby Ltd., Premier Works, Northington Street, London, W.C.1)

This splicer is a beautifully made example of the standard type of hand operated machine which is widely used in film laboratories and cutting rooms. The base is a solid steel casting and the two film clamps are gunmetal with their surfaces accurately surface ground. The cutting edges are of tool steel and are accurately ground and adjusted so that they cut perfectly and will continue to do so for long periods.



By virtue of the extremely solid construction and the precision of its manufacture this splicer makes perfect joins even when the operator is not extremely practised, and indeed the operation is simplicity itself.

A dry scraper is fitted for the removal of the emulsion from the film to be joined and this removes exactly the correct width and depth to give a true weld. The splicer will give equally good results on either nitrate or safety base stock given the correct cement and models are available to give either the negative or positive splice, a factor which is often overlooked and which if forgotten can produce the most unpleasant results on projection.

The joiners are finished in grey crackle enamel and can be confidently recommended where large quantities of rugged joins are to be made. Needless to say the equipment is just as suitable for cases in which only a little work is to be undertaken since the quality is such that it will materially aid the rapid production of a good splice. The price of the De Luxe Joiner is £6 6s. 0d.

P.I.M. 5×4-in. MONORAIL CAMERA

(Marketed by Ilford Ltd., Ilford, London)

This camera is a good example of the recent trend toward the use of monorail construction in the larger sizes of stand camera for professional use. In this model the monorail is of inverted V section with the rack for back and front panel focussing on its apex. The monorail is made from aluminium alloy with the rack in plated brass. The monorail can be attached to the tripod by a sliding head which may be locked in any desired position along the rail. The head is locked in position by turning either of two small tommy bars, one on either side of the head. If the camera is used on a bench two such heads are used.

The lens panel and the camera back are both mounted on identical carriages consisting of a sliding block which supports a U shaped bracket. The sliding blocks carry a central pinion which meshes with the rack on the monorail, operated from either side of the camera by a plastic knob on a cross shaft. The two blocks are locked in position along the rail with a tommy bar which operates an eccentric cam which bears on the underside of the monorail. The lens panel unit is supported within the U shaped bracket and has considerable freedom of movement. A rise and fall of 2¼-ins. above and below the central position is provided, cross front of 2½-ins., side swing of 30° on either side of the vertical axis and swing front of 35° away from the axis. All the movements are indexed for central positioning. The lens panel proper is 3⅞-ins. in diameter and is fitted into the front panel of the camera with a simple bayonet lock.

The carriage supporting the camera back is exactly the same as that which supports the lens panel and has the same freedom of movement. The back is of the standard spring type in which the slide is slipped in behind the focussing screen, and is reversible. The camera is designed to take 5×4-in. double dark slides of standard pattern.

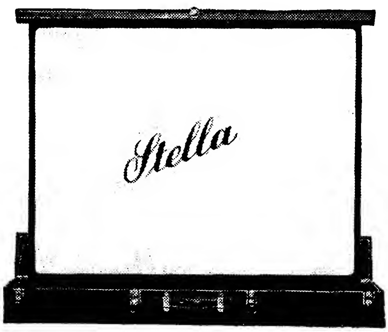
The square leather bellows has a maximum extension of 19-ins. and a minimum screen to lens panel distance is possible when both of the sliding blocks carrying the lens panel and camera back are on the same side of the tripod block.

With the exception of the lens panel and the control knobs the camera is constructed of aluminium alloy and has a total weight of 8-lbs. The price of the basic camera is £53 0s. 0d.

STELLA SELF-ERECTING SCREEN

(Actina Ltd., 10, Dane Street, High Holborn, London, W.C.1)

A fact which is sometimes overlooked when buying a projection screen is that for film work a horizontal shape is required of rectangular proportions whereas for the showing of still slides a square screen is needed so that either horizontal or vertical formats may be projected as they come. This range of Stella screens is available in either pattern.



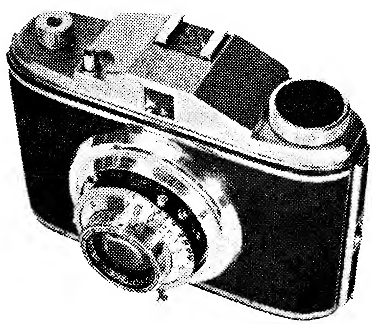
The screen is contained within a well made wooden box, leather cloth covered, which measures 3-feet 7-ins. by 5¼-ins. by 5¼-ins. for the 30×40-in. and 40×40-in. screen sizes. The outer box is beautifully made and finished, the lid being hinged throughout its whole length with a piano hinge. Four clasps are provided and a solid leather carrying handle. The corners of the box are properly protected with corner plates and the outward appearance of the case is most attractive.

On opening the lid the screen can be lifted into position by means of a large handle fixed in the centre of the top stretcher. The screen is rolled up when the box is closed and is drawn from its roller as the stretcher is raised in the usual way. The tensioning of the top stretcher to hold the screen flat is done by a pair of wooden arms which form a type of lazy tongs. These arms hold two strong coil springs in tension when the box is closed and the screen rolled up. As the screen is drawn upwards the pull of the springs tends to open the lazy tongs and erect the screen automatically. Once at its maximum extension the screen is kept taut by the pull of the springs. For a well made and well designed screen it would be hard to find anything better than this. The price of the 30 × 30-inch screen, beaded is £13 12s. 6d. and in white £11 5s. 0d. In the 40 × 40-in. size the prices are respectively for beaded and white; £15 0s. 0d. and £12 17s. 6d.

ISIS CAMERA

(J. J. Silber Ltd., 51/52 Avenue Chambers, Vernon Place, London, W.C.1)

The Isis conforms to the now popular camera style of a solid cast body which holds the two 120 size film spools close up against either side of the picture aperture, with the lens mounted at the forward end of an extending tube. Before the camera can be used the lens is drawn out of the body and the tube is given a slight clockwise turn to lock it in place.



A direct vision finder is fitted into the top plate of the body with a standard accessory shoe immediately above it. The lens is an f/3.5 coated Westar with front cell focussing mounted in a Prontor S shutter which is speeded from 1 sec. to 1/300 sec. with B setting. The shutter is flash synchronised and provided with a delayed action release. The body release for the shutter is fitted to the right hand side of the top plate of the camera and is interlocked with the film wind.

The top plate of the camera is finished in matt chrome and the remainder of the body in black grained leather. The lens extension tube is bright chrome plated. The price of the Isis is £16 0s. 9d. plus £5 4s. 3d. purchase tax.

BACOLET BATTERY-CAPACITOR FLASHGUN

(Neville Brown & Co., Ltd., 77 Newman Street, London, W.1)

For a neat and pocketable flashgun it would be hard to find anything more compact than the Bacolet; the reflector is 4¼-ins. in diameter and the battery casing does not extend outside this dimension at any point with exception of the foot which is used to mount the gun on the camera. Even this does not extend more than ¼-in. The reflector is of the highly polished type with concentric ribs to give an even spread of light.

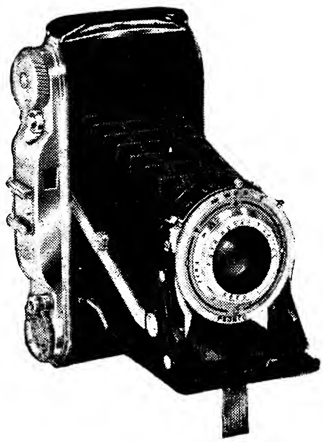
A plastic diffuser with a moulded ribbed pattern is supplied with the gun and can be fitted in front of the reflector by means of three hooked springs.

The battery casing is a black plastic moulding and the battery is inserted by first removing the reflector; the latter is held in place by a bayonet lock. A 22½-volt hearing aid battery is used to operate the unit. A synchronising lead with a standard Compur type plug is fitted and no provision is made for independent firing of the flash. The back of the battery casing carries an exposure table for the two smallest types of Photoflux bults, the PF 3 and the PF 14. The price of the Bacolet is £1 6s. 5d. plus 8s. 7d. purchase tax.

AGFA RECORD I CAMERA

(Agfa Ltd., Deer Park Road, Wimbledon Factory Estate, London, S.W.19)

The Record I is a folding roll film camera which is designed to give eight pictures 2¼ × 3¼-ins. on a 120 roll. The camera is of the type which has come to be accepted as conventional for this film size and consists of a slim pressed metal body the front of which opens to one side to form a baseboard for the lens on its panel.



The lens fitted to the model sent for review was an f/4.5 coated Agnar of 105-mm. focal length and was fitted in a four speed Pronto shutter. The lens has front cell focussing and the shutter is synchronised for flash. A body shutter release is provided but this is not interlocked with the film wind. The shape of the camera body is such that it can be easily gripped on the right hand side in spite of the fact that the baseboard hinges at this point, and the body release falls conveniently to the forefinger of the left hand. A depth of field indicator is fitted at this end of the camera top plate to match the film wind knob at the opposite end.

A direct vision optical finder is fitted into the top plate pressing and an accessory shoe above and slightly to the right of the finder eyepiece. The release for the baseboard catch is a large button in the centre of the top plate alongside the film wind knob.

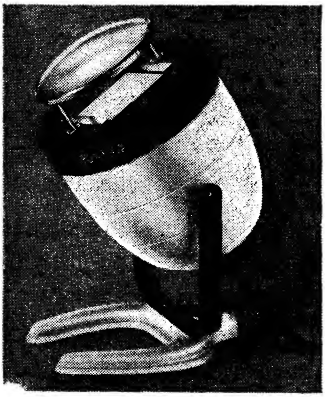
The Record is an exceptionally easy camera to load for the feed spool cradle hinges completely out from the camera body and has one end which can be swung out to insert the unexposed film spool. The take-up spool fitting is similarly well thought out; the winding knob has a spring loaded ball on its shaft which locates it positively either in or out of the body so that the knob does not have to be held out against spring pressure when loading or unloading the spool.

The external appearance of the camera is clean and attractive; the body is covered with a ribbed black plastic and the top plate and trim is an excellent matt chrome. The price of the Record with the lens and shutter described is £14 17s. 6d. plus £4 16s. 9d. purchase tax.

ILLUMINATOR MODEL 70

(Kodak Limited, Kodak House, Kingsway, London, W.C.1)

The 70×70-mm. size of film is now quite widely used for chest radiographic purposes such as the routine examination of hospital staff and follow-up cases. This new Kodak illuminator is accordingly a useful addition to the range of such equipment since its dimensions are in proper scale with the film size.



As can be seen from the illustration the lamphouse is basically similar to that used for the well-known Kodak Beehive Safelight and a 25-watt lamp is the standard light source. In the position normally occupied by the safelight filter is a black plastic disc with an opal viewing screen 62-mm. square in the centre. Radiographs are held in place over the diffuser by two chrome plated strips which are held to the plastic disc by two socket mountings. These mountings also form the sockets for a magnifier which is available as an accessory; this gives a magnification of 1½-times.

The mounting stirrup of the viewer is fixed to a heavy horseshoe-shaped stand the underside of which is felt covered.

The illuminator is obviously suited for the examination of all small radiographs, such as those used in dental work, and can also be used as a viewer for colour transparencies up to 2¼-ins. square. For this latter purpose a correction filter to raise the colour temperature of the illuminant will clearly be necessary. The illuminator is finished in cream enamel with the stirrup in black. A six-foot length of flex is provided. The price of the Model 70 Illuminator is £5 5s. 0d. and the magnifier costs £3 10s. 0d.

KLIPLITE LIGHTING UNIT

(Johnsons of Hendon Ltd., Hendon Way, London, N.W.4)

As its name suggests this lighting unit can be clipped into position on any available flat surface up to a maximum thickness of 1¼-ins. The base on which the reflector is supported consists of a pair of light alloy castings which are hinged together close to one end. The two castings are so shaped and spring loaded that they normally form a triangular base. When the side members are gripped and pressed together they pivot about the hinge and two rubber faced jawpieces at the apex of the triangle can be placed over the edge of any convenient solid object.

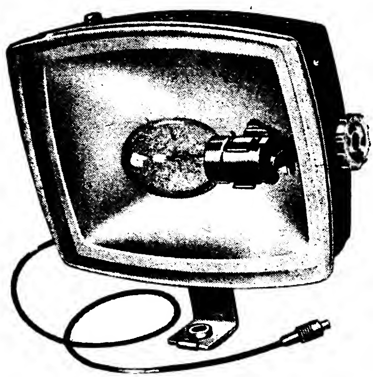
The reflector is supported above the base on a length of tube with a universal joint at the top. The length of the support tube is $6\frac{1}{2}$-in. A spun alloy reflector is fitted which has a maximum diameter of $7\frac{1}{2}$-ins. and is matt finished.

The supporting tube can be removed from the clamp base by slackening a milled head screw. If desired the clamp can then be fitted with a ball and socket head and used as a camera clamp in the absence of a tripod. The price of the Kliplite complete with reflector, flex and plug is £2 15s. 0d.

BILORA LUXA DE LUXE FLASH UNIT

(Actina Ltd., 10 Dane Street, High Holborn, London, W.C.1)

This flash unit uses a reflector of rectangular shape and the electrical components are built into the casing behind this reflector. This method of assembly gives an extremely compact unit, of a shape which can be packed rather more easily than can the conventional circular reflector. It can for instance, be slipped into a coat pocket.



The outer casing is a black plastic moulding and the reflector which fits into this casing in the form of a dished lid is of brightly plated metal. The reflector is completely covered by a transparent plastic cover which is hinged at the top of the reflector and clips into place when the bulb has been fitted into the holder.

A simple bulb ejector is fitted to the lampholder which is designed for use with any flashbulb with an A.S.C.C. cap. The cable which connects the unit with the camera is withdrawn from the casing when required and after use can be completely rewound into the casing by means of a small rotatable plastic knob on the side of the casing.

The foot which is fitted into the camera accessory shoe can be extended by a distance of about one inch by slackening a thumbscrew on the back of the casing and thus the reflector may be raised enough to clear cameras of varying design. A table of guide numbers for the Philips PF 3 and 14 flashbulbs and the German Osram XP and XO flashbulbs is provided on the back of the casing. In sum the Luxa de Luxe is a neat and well designed flash unit and reasonably priced at £2 9s. 6d. plus 16s. 2d. purchase tax.

ROLLEI AUXILIARY FOCUSSING KNOB

(R. F. Hunter Ltd., Celfix House, 51 Gray's Inn Road, London, W.C.1)

There are occasions when even the most convenient and well-designed camera is none too easy to use; the manipulation of such items as shutter setting rings and focussing knobs in extreme cold when wearing gloves is the obvious example which springs to mind. Under normal conditions the focussing knob of the Rolleiflex and Rolleicord cameras is unexceptionable being reasonably large and easy to manipulate accurately. This auxiliary focussing knob is however, designed to make the job simple even under the most difficult conditions.

The knob is 1½-in. in overall diameter and carries on its outer surface a double row of large size serrations to give a good grip. It is fitted over the existing knob on the camera quite simply by holding it with two fingers and depressing the centre portion with the thumb. This opens three spring loaded jaws which firmly grip the camera knob when the auxiliary knob is released.

The scaling of the auxiliary knob is in feet and the figures are large and clearly marked. This fact alone would make the knob a worthwhile acquisition for those who have any difficulty with the size of the figures as engraved.

In addition to the features as enumerated the knob also incorporates a film type and speed indicator which can be set to show what the camera is loaded with. The price of the auxiliary knob for either the Rolleiflex or the Rolliecord (different models are required) is £4 4s. 0d. plus £1 7s. 4d. purchase tax.

DIA SLIDE BOX

(J. J. Silber Ltd., 51/52 Avenue Chambers, Vernon Place, London, W.C.1)

The storage of 2 × 2-in. colour slides represents a problem, and if the slides have at the same time to be transported from place to place the problem becomes even worse. In the first instance the slides must be protected from dust and damp, and if they have to be carried then the storage means must not be unduly heavy or bulky in relation to the number of slides which it holds.

These slide boxes fulfil both demands and at the same time present an outward appearance which is extremely attractive. They are made completely from wood and the quality of the workmanship is really good. The joints are dovetailed and glued and the boxes natural finished with clear varnish. The size of the box is 10 × 8¼ × 2¼-in. and it will hold 100 slides. Each slide is held individually in separate slots in separator panels and there is thus no chance of their damage by rubbing together when they are being carried. An index card is provided for the rapid location of any slide in the numbered slots. The price of the Dia slide box is £1 2s. 6d.

DX80 X-RAY DEVELOPER

(Kodak Limited, Kodak House, Kingsway, London, W.C.1)

DX 80 is a new X-ray developer which is packed in the form of concentrated solution. This method of packing makes the solution easy and quick to prepare for use and in addition avoids the risk of contamination of sensitive material by particles of dry chemical floating in the air of the darkroom. Although the developer is specifically intended for the development of X-ray material it is equally suitable for the processing of oscillograph records and in clinical, aerial, infra-red and general industrial photography.

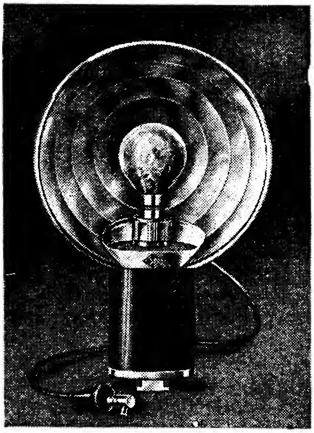
The concentrated solution is supplied in 1-gallon bottles; is diluted 1—4 for use. The recommended development time at 68° F. for X-ray films is four minutes, the manufacturers state that if extra emulsion speed is required this development time may be extended without the contrast rising to an unreasonable extent and with a small build-up of fog. The developer keeps well and gives uniform speed and contrast over an unusually long working life. A replenisher solution is available, DX 80R, also in 1-gallon bottles which are diluted 1—4 for use. A volume of replenisher equal to the original developer volume can be added before the solution is discarded.

The price of DX 80 developer is £1 5s. 0d. for the 1-gallon (4½-litre) bottle and DX 80R replenisher costs £1 9s. 6d. for 1-gallon.

AGFA FLASH GUN KL

(Agfa Ltd., Deer Park Road, Wimbledon Factory Estate, London, S.W.19)

This flashgun is a modified version of the Agfa flashgun type K and the design has been so contrived that it can be packed within a space 5¼-ins. in diameter and 1½-ins. deep. In fact a smart brown plastic case with these dimensions is provided with the gun.



When assembled for carrying, the body of the unit which carries the battery and the capacitor is nested within the reflector and the complete gun therefore has the dimensions of the reflector. When it is desired to put the gun into action the lamp socket, which is used to hold the two components together, is unscrewed and the two parts reassembled the opposite way around; that is with the body casing outside the reflector and the lamp socket within it. This is the situation as shown in the illustration.

The reflector is of the polished type with four concentric facets to spread the light. The body of the gun consists of an oval tube of ribbed plastic; it is dismantled to insert the 22½-volt deaf-aid battery by slackening the foot mounted on the base whereupon the base and the outer casing can be drawn from the main chassis. The unit is normally supplied with only the accessory foot for fitting to the camera but a standard camera bracket can be obtained if desired.

A bulb ejector is fitted, of the type which simply needs a turn of the socket in a clockwise direction, and the plug which connects the gun to the shutter is provided with a neat rubber skirt which covers it completely and prevents accidental shorting of the connections and firing of the flash. The price of the Agfa Flashgun KL is £2 9s. 9d. plus 16s. 2d. purchase tax.

TRIBOLUX VISUAL EXPOSURE METER

(Photo-Science Ltd., 10 North End Parade, London, W.14)

This little meter, measuring only 2½ × 2¼ × 1-in. and weighing only 3½-ozs., is to the best of our knowledge the only visual meter employing an accurate photometric device, other than the far more expensive and elaborate S.E.I Photometer. The Tribolux does not seek to compete with that unique instrument: it measures the average scene brightness, like any photoelectric meter, but it does it by the visual matching of this average against a photometrically controlled light strip.

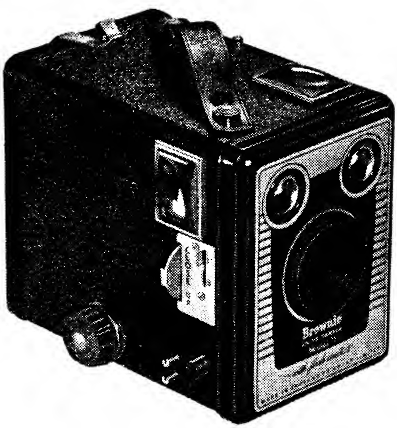
The Tribolux is simple and quick to use. You point the window at the subject, look down a tube at a patch of light traversed by a dark band; press the button and rotate the calculator disc until the patch and the band match; and read off the exposure.

The meter is very sensitive—it will give readings in dim light needing an exposure of 15-20 secs. at f/8 with a 28° film—and it has an unusually small acceptance angle of about 30°, so that objects outside the chosen field of view have little effect on the reading. The lamp is an ordinary flashlamp bulb, and the battery, which is quickly and easily replaced, is a No. 8 torch battery. Cleanly finished in maroon plastic, the price is £2 5s. 0d. plus 14s. 8d. purchase tax.

SIX-20 BROWNIE CAMERA MODEL D

(Kodak Limited, Kodak House, Kingsway, London, W.C.1)

There is scarcely any need to describe the outward form of this new model Six-20 Brownie for it is, like all the models which have gone before it, a simple box camera. There is little need to revise the shape of the simple camera, for after all the plain box form is logical and simple to construct. However the Model D has been made a more versatile camera by the addition of flash contacts on the shutter and building in a supplementary lens for close shots.



The body of the camera is a steel pressing with an interior body unit which carries the two film spools and is removable for loading and unloading. The outside of the camera is covered in pin-seal leather cloth and a carrying handle is provided on the top.

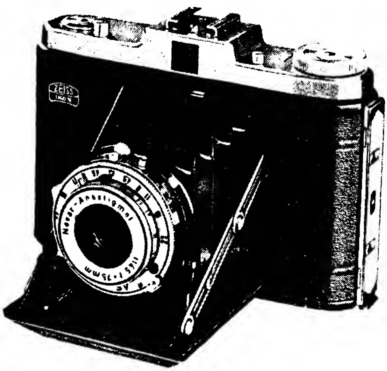
Two large size waist-level finders are provided and these give a good bright image. The shutter release is a plunger mounted near the bottom of the body where it can be most conveniently operated with the thumb of the right hand. The shutter can be set to give an instantaneous exposure or brief time exposures, and just behind the setting lever for this is mounted a small protruding metal strip which when pulled out slides the supplementary lens into place behind the camera lens.

The connections for the lead to the flash unit take the form of two small pins which protrude from the camera body just behind the shutter release plunger. The price of this nicely made, versatile box camera is £1 15s. 0d. plus 11s. 5d. purchase tax.

ZEISS IKON NETTAR 517/16 IPMS

(Peeling and Komlosy, 181 Victoria Street, Dunstable, Bedfordshire)

This new model of the well-known Zeiss Ikon Nettar is designed for 12 pictures 2¼-in. square on 120 roll film. The body of the camera, a well made metal pressing, fits nicely into the hands and the general shape of the camera is such that when it is closed it can be slipped into the pocket with ease should an ever-ready case not be preferred.



The drop baseboard, which is rigidly strutted, opens downward in this model and the lens panel is supported extremely firmly. The lens is an f/4.5 coated Novar of 75-mm. focal length with front cell focussing. The shutter of this model is an eight speed Prontor SV with speeds of 1 sec to 1/300 sec with Brief time setting. The shutter is synchronised for M and X delay flash and has delayed action release. A similar model of this camera is also available at a lower price with a five speed Velios shutter.

A body release for the shutter is fitted but this is not interlocked with the film wind. The chrome top plate of the camera body carries a direct vision optical finder above which is fitted an accessory mounting shoe.

The camera is a delight to use and is beautifully finished in black grained leather. The price of the Nettar 517/16 IPMS with the Prontor SV shutter is £16 17s. 6d. plus £5 9s. 8d. purchase tax; the price of the Nettar 518/16 IH with the Velio shutter is £12 2s. 6d. plus £3 18s. 10d. purchase tax.

WRAYFLEX MICROCOPYING UNIT

(Wray (Optical Works) Ltd., Ashgrove Road, Bromley, Kent)

Any photographer who has used one will agree that the single lens reflex camera presents a number of advantages for copying work. This simple unit enables the Wrayflex to be used for making document copies on 35-mm. film and the reflex viewing system makes the positioning of the document on the baseboard easy and certain.

The baseboard and column are identical with those supplied for the Wrayflex enlarger and the extra components comprise a supporting bracket for the camera and a 6-mm. extension ring which enables the camera to be focussed at distances between 1.5 and 2-ft. With the aid of the regular series of adapter rings supplied for use with the Wrayflex a complete range of reductions from 9× down to 2× can be covered.

The 24×32-mm. format of the Wrayflex gives 42 pictures on the standard cassette load of film. The price of the Micro-Copying Unit is £6 0s. 0d. plus £1 19s. 0d. purchase tax.

BILORA BELLA CAMERA

(Actina Ltd., 10 Dane Street, High Holborn, London, W.C.1)

The body of the Bella is a moulding in black plastic which is slim enough to enable the camera to be easily slipped into the jacket pocket. The lens is mounted on a retractable tube which is pulled out when it is desired to use the camera; the tube is lightly spring loaded so that it springs into its proper position once it has been started by a slight pull.

The lens fitted is an f/9 achromat which can be focussed down to five feet by turning the mounting cell. Intermediate focussing positions are provided at nine and fifteen feet. The simple everset type shutter gives either instantaneous or time exposures and is provided with a flash connection of the standard Compur type. A body shutter release is provided in the front of the body moulding.

A direct vision optical finder is moulded into the top of the camera body and immediately above this is an accessory shoe. The film is wound on with a flat milled disc only the edges of which protrude from the camera body. The camera back is completely removable, which facilitates loading, and the lock for this is mounted concentrically with the red film indicator window.

The Bella is designed for size 127 film and gives eight pictures $2\frac{1}{4} \times 1\frac{5}{8}$-ins. on the roll. Two clips for a carrying sling are firmly fixed to the camera top. The price of the Bella is £3 15s. 3d. plus £1 4s. 6d. purchase tax.

SPECIALIST MASKING BOARD MODEL 2

(Kodak Limited, Kodak House, Kingsway, London, W.C.1)

This new masking board is similar to its predecessor which itself incorporated a number of design points of proved value in hard and long usage. The Model 2 will give prints ranging in size from 2×2-ins. to $11\frac{1}{2} \times 14\frac{1}{2}$-ins., and a scaled margin guide on the baseboard can be adjusted in steps of $\frac{1}{4}$-in. to give margins from $\frac{1}{4}$-in. to 2-ins. in width.

The baseboard is of wood with the upper surface finished in white for focussing. The size of the baseboard is $19\frac{1}{2} \times 16\frac{3}{4}$-ins. and the underside is cloth-covered so that it can be moved over the enlarger baseboard easily and without scratching. The masking bands are fixed to an L shaped member which is hinged to the baseboard at the back. The hinged arm is controlled by a friction stay so that the mask assembly remains fixed in position when raised leaving the operator with both hands free to manipulate the paper. This provision materially aids the speed with which the frame may be used and leads to a steady rhythm of operation. The adjustable mask bands slide in grooves of the main L shaped arm which is scaled in ¼-in. divisions with white figures against a black background. A white tipped pointer indicates the size of the masked opening on the graduations. Metric graduations can be provided if desired. The price of the Kodak Specialist Masking Board Model 2 is £9 0s. 0d. plus £2 18s. 6d. purchase tax.

MINISTROBE ELECTRONIC FLASH UNIT

(Langham Photographic Instruments Ltd., 132 Stanley Park Road, Carshalton, Surrey)

This unit represents electronic flash reduced to its simplest and most portable form; the complete unit comprises only a small battery case which measures $3 \times 4 \times 4\frac{1}{2}$-in. and weighs 2 lb. 5 oz., and the flash head which consists of a deep 6-in. reflector on a body which measures 5-in. long by 1¾-in. diameter. Thus it will be seen that the flash head is certainly no bigger than a battery-operated unit for expendable bulbs such as was commonly used only a year or so ago.

All the electrical components with the exception of the battery are contained within the flash head and the outside of this component is finished in an attractive light grey enamel. The interior of the reflector is finished in matt aluminium. The flash tube is the usual low-voltage, hairpin type, is mounted directly on the back of the reflector and has no outer glass bulb. At the back of the reflector housing are mounted the indicator neon and the open flash release button.

A 2-ft. 4-in. length of lightweight cable connects the battery pack to the flash head and the synchronising lead to the camera shutter is provided with a standard Compur type plug.

The battery case carries the two 90-volt layer-type batteries and connection to the head lead is by a non-reversible plug-and-socket mounted on the side of the leather case.

The flash head is mounted on a camera bracket which gives a choice of four camera screw positions between centres of 5-in. and 6¾-in. The bracket is faced with rubber where it bears against the camera body, and a dowel locates it with the base of the flash head in proper position. The price of this neat and elegant electronic flash unit is £10 7s. 9d., plus £3 9s. 3d. purchase tax. The batteries cost 18s. 6d. each.

3-in. F/1.9 CINE LENS

(J. H. Dallmeyer Ltd., Church End Works, Willesden. London, N.W.10)

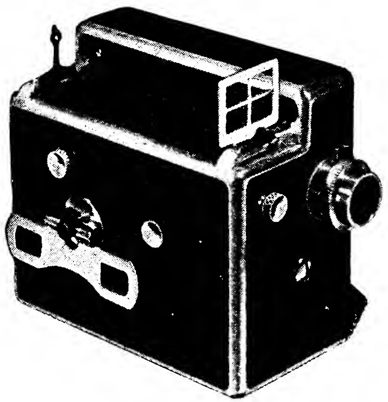
This cine lens is intended for use with any 16-mm. camera which will accept lenses with Standard "C" mounts; that is a standard register of 0.690-ins. with a mount of 1-in. diameter threaded 32 t.p.i. The lens is a good example of the extreme aperture long focal length type for 16-mm. use and the outward appearance is in every way compatible with the high quality cameras with which it is designed to be used.

The lens is coated and the mount is of light alloy; this latter point enables the weight to be kept down in spite of the large diameter glasses. The price of the 3-in. f/1.9 Cine lens is £21 15s. 0d. plus £7 1s. 5d. purchase tax.

PAT 9.5-mm. CINE CAMERA

(Pathescope Limited, North Circular Road, Cricklewood, London, N.W.2)

Over a period of many years Pathescope have catered for the amateur cinematographer of limited means with good equipment at modest prices; this new 9.5-mm. cine camera is certainly the lowest price cine camera available today and represents a continuation of this policy.



The camera is designed to take the standard Pathescope H-type charger and is of simple boxform construction. The body is an alloy diecasting divided internally into two compartments; the back compartment, which is on the right when the camera is held in the operating position, contains the spring motor and film drive system, the front compartment is the film chamber. The exterior of the camera is finished in black crackle with natural finish edge trim, and the winding key, release button and inching knob are finished in chrome.

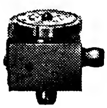
A direct-vision frame finder is fitted, consisting of an aperture backsight and a frame foresight.

The lens is fitted with a two-aperture Waterhouse stop of unspecified f/numbers which are stated to be suitable for dull and bright exterior conditions on Pathescope SS film. The lens is interchangeable with an f/2.5 anastigmat of fixed focus, an f/1.9 Berthiot anastigmat in focussing mount or a 50-mm. f/3.5 Berthiot long-focus lens in focussing mount. The price of the Pat cine camera with standard lens is £10 10s. 0d. plus £3 8s. 3d. purchase tax.

SHUTTER AIR VALVE

(Thomas S. Day, 43 York Street, Twickenham, Middlesex)

This new valve is designed to be used with the well-known Day air-operated shutters which were described in the *British Journal Almanac* for 1952 and 1953. The developments which have taken place in the equipment each year have been designed to increase both the accuracy and the utility of these well-made shutters, and this new air valve is no exception to the rule.



Like its predecessor, the valve is inserted in the air line between the shutter and the compressor or rubber bulb which supplies the air pressure which operates the shutter. However, the new model gives an extended and extremely useful range of shutter speeds, the precise range depending on the size of the shutter with which it is used. When used in conjunction with the compressor which was described in the 1953 *British Journal Almanac*, the complete assembly provides a large-size professional-type shutter with a good speed range and high accuracy—certainly an accuracy high enough for colour work.

With shutter sizes between 30 and 75-mm. the valve provides the following speeds: 1/40, 1/30, 1/20, 1/10, 1/4, 1/2, 1 and 2 seconds and Time. With shutters between 80 and 120-mm. in size, the higher speeds are naturally not possible and the range becomes 1/25, 1/20, 1/10, 1/8, 1/4, 1/2, 1 and 2 seconds and Time. With a 135-mm. shutter the speed range is 1/16, 1/8, 1/4, 1/2, 1 and 2 seconds and Time. The valve will give these same speed ranges when used with the manually-operated rubber bulb but as one would expect, the accuracy of the exposure time is somewhat dependent on the operator.

The valve is nicely made and easily adjusted and the speed settings are clearly marked on the top setting disc. The price of the valve is £1 16s. 0d. and purchase tax of 12s. 10d. is chargeable only when the valve is purchased separately from the shutter with which it will be used or if it is purchased with a shutter smaller than 50-mm. in size.

FOCAL COLORTONE OUTFIT

(Photo-Synthetics (Distributors) Co., 15 College Road, Epsom, Surrey)

This useful outfit enables the photographer to produce what is virtually an unlimited range of colours either on bromide prints or transparency positives. The outfit comprises chemicals in powder form sufficient to make 2 litres of stock solution of colour developer and three tubes of colour former solutions, cyan, magenta and yellow.

With suitable types of bromide and chlorobromide paper the colour images may be produced by direct development, that is the exposed print is developed in the colour developer containing a suitable proportion of one or more colour formers. With some types of papers, however, it is preferable to use an indirect procedure, first developing the print to black and white in the usual way and then bleaching and redeveloping in the colour developer as before.

A number of basic proportions for the production of a range of some seventy-five colours are given in the instruction leaflet packed with the outfit and there is no doubt that with a few tests it would be possible to produce any desired colour with certainty and repeat it as often as desired in the future. If a pure dyestuff image is desired, that is without any black silver which is normally developed along with the dye, the silver can be bleached with Farmer's reducer. The price of the Focal Colortone Outfit is 6s. 0d.

MINEX PROFESSIONAL ENLARGER

(A. Adams & Co., Ltd., 53 Wigmore Street, London, W.1)

The new and improved model of the well-known Minex enlarger now incorporates a number of features which make for easier working and greater rigidity. The enlarger is a wall mounting model and the main chassis which is fixed to the wall is a ruggedly constructed wood framework. The carriage which carries the enlarger head is traversed up and down the main chassis by a long lead screw operated through right-angle gearing from a handwheel fitted at bench level on the right of the enlarger.

The enlarger head is supported on a strong and rigid bracket and a second smaller screw is utilised for coarse focussing. This is operated from a small handwheel fitted at the side of the head bracket. Fine focussing is accomplished by a handwheel which works a rack and pinion in the conventional fashion.

Negatives up to $8\frac{1}{2} \times 6\frac{1}{2}$ ins. in size can be handled and a nesting carrier is provided so that all standard sizes down to $3\frac{1}{2} \times 2\frac{1}{2}$ can be printed. The bellows extension is 22-ins. maximum measured from the carrier to the lens; the bellows are well made from leather.

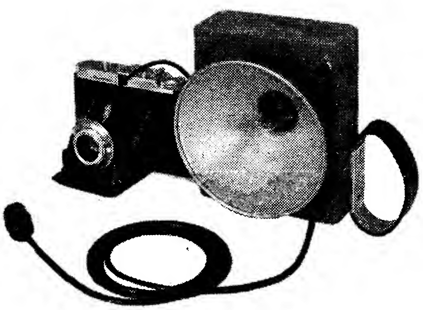
The lamphouse is normally fitted with five 75-watt tungsten lamps and an opal diffuser ensures that the illumination is perfectly even. As an alternative a cold cathode unit can be fitted without difficulty.

The enlarger is well made from seasoned wood and bearing surfaces are faced with brass where necessary. The price of the Minex enlarger with tungsten illumination is £110 0s. 0d. and with a cold cathode unit £145 0s. 0d.

CADET ELECTRONIC FLASH UNITS

(Clive Courtenay & Co., Ltd., Horsham Road, Dorking, Surrey)

This range of electronic flash units is based on a flash head of a standard though rather novel pattern and by variation of the internal components of the head three separate units of varying power can be provided. The three units are called Cadet I, II and III.



The Cadet I is shown in the illustration and is the simplest and lowest priced of the three. It is designed for operation from alternating current mains between voltages of 200 and 240. The head casing consists of a metal pressing on the front of which is mounted the reflector. The dimensions of the casing are $6\frac{3}{4} \times 5\frac{1}{2} \times 3\frac{1}{2}$-ins. the depth being measured over the reflector. The flash tube is the simple U-shaped type and is protected by a sheet of clear plastic which is spun into the front of the reflector.

The output of the Cadet I is 25 joules and the flash factor with a 32° B.S. film is given as 120/150. In a room of average reflectivity tests showed that the highest rating gave a negative which was just satisfactorily exposed. The recharge time between flashes is of the order of eight seconds. An indicator neon is fitted to the back of the casing. The only other fitting is a simple toggle switch which performs the double duty of on-off switch and firing switch for open flash working; switching off automatically fires the unit. A synchronising lead is provided for connection to those cameras which have X synchronised shutters and this is plugged into the front of the unit.

The camera bracket can be fitted either to the left or right of the unit and a short leather strap is fitted to the opposite side to that on which the camera is placed. Thus the complete unit with camera is held with the hand through the strap on one side and the camera held with the other hand.

The Cadet II is exactly the same as the Cadet I in outward appearance and is handled in exactly the same way. This unit, however, is operated from a high capacity 250-volt battery which is carried in a high quality leather case on a shoulder sling. The flash head in this case contains the power capacitors and the output of the unit is 40 joules and the flash factor for a 32° B.S. film is 120/150. The recharge time between flashes is four to five seconds. The battery in its case is small and light enough to be easily carried and will give over 2,000 flashes. This unit is the obvious choice of the three when an extremely portable outfit which is independent of mains supplies is needed.

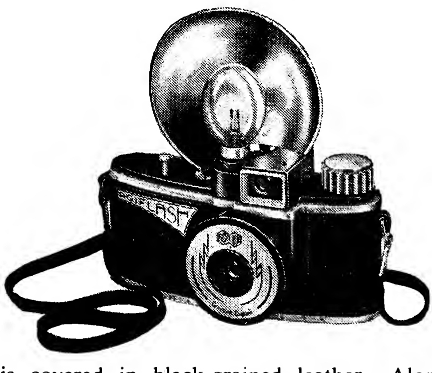
The Cadet III is available with a choice of two types of flash head giving either 50 or 100 joules output. The power pack operates from a 4-volt accumulator which will give approximately 130 flashes per charge when used at 100 joule output or double this number at 50 joules. Two flash heads can be used from the power pack if desired.

All the flash heads of these three units are finished in a grey crackle enamel and the camera bracket is faced with rubber where it bears against the camera body. Altogether this new series of flash outfits form a valuable addition to the already wide range of this manufacturer and the rationalisation of the flash head leads to a useful reduction in costs. The prices of the units are: Cadet I £10 10s. 0d. plus £3 10s. 0d. purchase tax; Cadet II £13 12s. 3d. plus £4 10s. 9d. purchase tax; Cadet III with 50 joule head £18 12s. 0d. plus £6 4s. 0d. purchase tax. With 100 joule " Keelite " head the price of the Cadet III is £23 6s. 6d. plus £7 15s. 6d. purchase tax.

AGIFLASH CAMERA

(Agilux Ltd., Purley Way, Croydon, Surrey)

Since, in recent years, both the components in flash equipment and the bulbs that are used with it have become so much smaller in physical dimensions it is a logical step to incorporate the flash unit into the camera. The Agiflash is a miniature style camera which gives pictures of full vest-pocket size ($2\frac{1}{2} \times 1\frac{5}{8}$-in.), has a battery compartment and carries on the top-plate of the body a socket for all flashbulbs with A.S.C.C. cap and in spite of all this is still little if any bigger than a standard camera for this negative size.



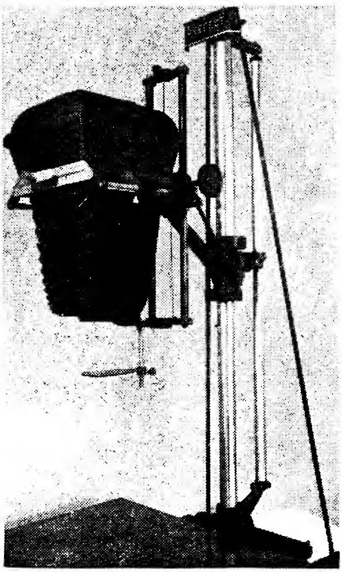
The body of the camera is a moulding in black plastic which is covered in black grained leather. Alongside the direct vision optical finder which is moulded integrally with the body is the flash lamp socket. When this is required for use a small blanking plug is removed from it and a 3¾-in. reflector is plugged into a socket behind the lamp socket. A small lever at the side of the lamp socket causes the spent bulb to be ejected, under pressure of the lower contact spring, when it is pulled to one side. The batteries (two pen torch cells) are fitted in a compartment alongside the film spool chamber on the right of the camera.

The lens fitted is a meniscus in a fixed focussing mount with a single-speed shutter. A body release is fitted for the shutter and this has an agreeably positive action and rather unusual design. The price of the Agiflash camera is not yet fixed at the time of going to press.

PREFECT BENCH ENLARGER

(Pelling & Cross Ltd., 104 Baker Street, London, W.1)

Designed to print from negatives ranging in size from 6½ × 4¾-ins. down to 35-mm. this enlarger incorporates one or two novel features which we do not recollect having seen in a professional enlarger of its type. The baseboard and column unit are fairly conventional in design, the baseboard being 24 × 26-ins. in size and the column 45-ins. in height. The main column has behind it a supplementary column of smaller diameter which serves both to keep the enlarger head correctly centred over the baseboard and also to provide some extra bracing in a fore-and-aft direction. The columns are braced with two steel rods which extend downwards and backwards from a top casting to two cast arms which extend from behind the baseboard.



The head unit is counterbalanced on the column and is locked in position very positively by a clamp which applies side pressure. The clamp is freed by gripping with one hand a bar which projects outward from the bracket casting and pressing it inward toward the bracket against spring pressure. As soon as the bar is released it grips the column firmly.

The lighting unit is a cold cathode and the lens panel is carried on two rods which slide in ball bearings in the bracket casting. A stranded steel wire runs parallel to these two rods and midway between them. This wire is taken round a shaft which is mounted in bearings in the bracket and thus when the shaft is rotated by the large handwheel with which it is provided it moves the two rods through their bearings in the bracket and takes the lens panel with them. Thus a stable and rigid mounting is provided for the unit by virtue of the large bearing surface for the rods and a drive free from backlash is ensured by the drive system. A bellows extension of 18-ins. down to 2-ins. is provided and both the enlarger head and the lens panel may be tilted for the correction of verticals.

The enlarger is finished in dark grey crackle enamel with the baseboard polished and the column chromed; an orange filter is fitted on an arm on the lens panel and the enlarger is supplied with four carriers. The price of the Prefect enlarger is £68 10s. 0d.

B.60 COMMERCIAL FINE-GRAIN PLATE and B.61 SOFT GRAVURE PLATE

(Kodak Limited, Kodak House, Kingsway, London, W.C.1)

These two new materials are specifically intended for photomechanical use and their speed is similar to Kodak B.40 and B.50 plates. The two new plates however normally develop to a much lower contrast than the latter two materials.

Both the B.60 and B.61 plates are coated with a slow, fine-grain, blue-sensitive emulsion with low contrast and long scale of gradation. Tests show that the emulsion can be satisfactorily reduced in dot etching with the minimum of stain, and the surface can be easily lacquered for after-work.

The long scale of gradation makes these plates extremely well suited to the production of continuous tone negatives and positives for photogravure and for low contrast masks. The plates can of course be used in general photographic work where green or red sensitivity is not needed; it would, for example, be ideal for use in the making of copy negatives.

The emulsions of the two plates are identical, but the B.61 plate is available only on glass 0.080-ins. thick and is intended for making photogravure assemblies.

VANGUARD PRESS ENLARGER

(Pelling & Cross Ltd., 104 Baker Street, London, W.1)

This fine enlarger incorporates many of the features which have made the Kamm Vanguard enlarger distinguished and is specifically designed for coping with negative sizes between $6\frac{1}{2} \times 4\frac{3}{4}$-ins. and $2\frac{1}{4}$-ins square. The enlarger is a bench model with focussing and size of picture controlled by two handwheels at bench level (a tubular steel stand can be supplied if required); the friction on the handwheel controls can be adjusted to suit the operators' particular taste. The support for the enlarger head consists of a double steel tube, the two being set side by side and touching each other; the ball bearing slides on which the head runs up and down the column fit into the V formed by the tubes butting together. The head of the enlarger is counterbalanced and the drive from the handwheels and this counterbalancing are coupled together by stranded steel cables.

The columns and driving gear are totally enclosed by a heavy gauge sheet steel boxform construction finished in a light grey anodic finish; on the front face of this on the right of the operator is provided an unscaled white panel which can be marked as desired to form a simple automatic focussing system or the conjugates to provide prints of a fixed size for subsequent repetition.

The lighting unit is a Photogrids cold cathode unit and this is switched on and off by a microswitch which is fitted at the back of the film carrier holder so that the insertion of the carrier can be made to operate the switch. Carriers are available for all film sizes from $6\frac{1}{2}\times4\frac{3}{4}$ to $2\frac{1}{4}$-ins. square and an extremely neat device is used to hold the top plate of the carrier off the negative when it is desired to draw roll film strip form through the carrier. A small permanent magnet is fitted at the front of the lamphouse a fraction of an inch above a small iron strip fixed to the top plate of the carrier; when the pressure is taken off the film by pushing up the carrier top plate the magnet holds it in that position until it is depressed again.

Above the carrier within the lamphouse frame is fitted a sliding shutter so that if the lamp is left on and the carrier withdrawn the shutter falls and immediately prevents light leakage. The shutter is automatically pushed upwards again as the carrier is pushed into place.

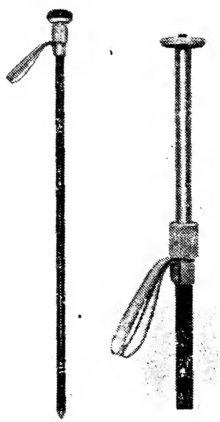
A three lens turret is fitted as standard and this is indexed for positive placing of the lenses in the dark. The bellows is capable of extension to 26-ins. and can be contracted to $2\frac{1}{2}$-ins.

A de luxe model of the enlarger is available which incorporates a solenoid operated shutter which is operated from a panel just under the front edge of the baseboard. The panel is adequately large to permit the incorporation of other switching should this be desired, or the fitting of an electronic timer. An orange focussing filter is provided which snaps out of the light beam at a touch and a three filter holder is also provided. The price of the Vanguard Press enlarger is £115 0s. 0d. for the standard model whilst the de luxe model costs £129 18s. 0d.

N.S. UNIPOD

(James A. Sinclair & Co., Ltd., 3 Whitehall, London, S.W.1)

When closed this unipod closely resembles a walking stick, an impression which is strengthened by the excellent finish and elegant appearance. When closed the length is 34-ins. and when the locking screw is released the inner tube may be drawn out to give a maximum operating height of $64\frac{1}{2}$-ins. The two tubes are made from duralumin and the weight of the complete Unipod is only 14-ounces.



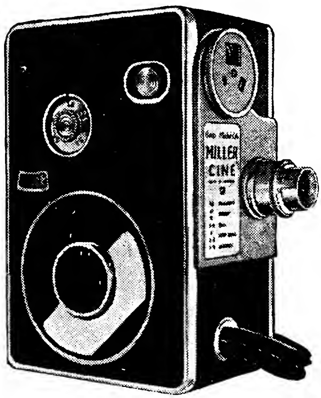
The outer tube is finished in a fine black anodising, as is the knob which conceals the tripod screw. The remainder of the metal is natural finished. When the knob is removed the tripod screw is immediately exposed; this latter is reversible to accommodate cameras with either British or Continental size bushes. The amount of projection of the tripod screw is adjustable by means of a small box spanner which is provided, for different depths of tripod bush on the camera.

The extension can be locked at any point between the maximum and the minimum quoted above by tightening the knurled locking screw visible beneath the knob. The camera platform, when the knob is removed, is some 2-ins. in diameter. The price of this beautifully made unipod is £4 5s. 0d.

8-mm. CINE CAMERA MODEL CA

(The Miller Cine Co., Ltd., 106 Barton Street, Gloucester)

This new model camera is basically similar to the original Model C Miller camera but the body is now a die-casting instead of a metal pressing, and a number of improvements have been incorporated. The exterior of the camera is covered with an attractive leather-grain brown plastic, which is extremely tough, the lens panel is finished in brown enamel, and the edges of the body, the winding key and trimmings are in bright chrome. The whole appearance of the camera is most attractive. A wrist sling is provided which enables the camera to be firmly gripped when it is being used in the hand, and the release button, which is of the slide type, is fitted on the right-hand side of the body where it can be most conveniently operated.



The camera is easy to load, the pressure-pad of the gate being of the type which can be swung clear on a top hinge. Standard double-run 8 mm. spools are used and the footage indicator is operated by the conventional feeler finger which bears on the film on the feed spool.

The standard lens fitted to the camera is an f/2.5 anastigmat of 12.5 mm. focal length in a fixed focus mount. This lens is fitted with a standard mount and can be interchanged for lenses of longer focal length if desired.

Film speeds of 8, 16, 24, 32 and 64 frames/sec. are provided and at 16 frames/sec. the spring motor will run approximately 30 seconds on one winding. Single-frame release is also provided, by pushing the release button forward instead of back.

A direct-vision optical finder is fitted within the body of the camera and this is equipped with a rotating mask which indicates the field for 1-in. and 1½-in. lenses in addition to the standard 12.5 mm. lens.

In all this camera represents excellent value, it performs extremely well and looks good. The price is £22 10s. 0d. plus £7 6s. 3d. purchase tax.

MANOTONE TONER

(Philadelphus Jeyes & Co.. Ltd., 6 The Drapery, Northampton)

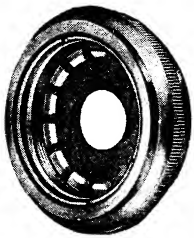
Manotone is a new toning chemical which is used in a similar fashion to the conventional sulphide toner and gives a wide range of brown tones. Prints which are to be toned are first bleached in a ferricyanide-bromide bleach such as is used for sulphide toning and then darkened in Manotone solution made alkaline with sodium carbonate. The darkening solution is made up as two stock solutions and by varying the proportion of alkali to Manotone the colour produced in the toned print can be varied. The precise colours produced vary with the make and type of paper on which the print has been made and with the temperature at which the toning bath is operated. Variations from one fifth as much alkali as Manotone to equal proportions will give tones which generally range between cold sepia and warm brown.

The price of a 20-gram bottle, which will make two litres of Manotone stock solution, is 6s. 0d.

IRIS DIAPHRAGMS

(J. H. Dallmeyer Ltd., Church End Works, Willesden, London, N.W.10)

Although the photographer is most familiar with the iris diaphragm as being incorporated in his camera lens these intricate devices perform a useful job in other spheres too. These Dallmeyer iris diaphragms are supplied in a range of twenty-three sizes and are widely used for scientific and industrial purposes.



The smallest size has a maximum aperture of 0.30-ins. (8-mm.) and a minimum aperture of 0.025-ins. (0.60-mm.) whilst the largest has a maximum aperture of 4.575-ins. (116-mm.) and a minimum aperture of 0.425-ins. (11-mm.).

The diaphragms are so designed that the overall diameter is as small as possible and they are available in two styles, one with a milled outer ring which operated the leaves, the other with a small operating handle. The prices range from £1 0s. 5d. for the smallest diaphragm to £7 4s. 0d. for the largest.

MAJOSIX ENLARGING EXPOSURE METER

(Photax (London) Ltd., 70 Charlotte Street, London, W.1)

Many instruments have been designed, and some marketed, with the object of enabling the exposure required in enlarging to be directly read off, thereby doing away with the need for test strips. Mostly those which have been marketed have been of the visual photometric type, and there is no doubt that the best of these can be a very useful aid. In these days however, the call is always for a direct reading photo-electric exposure meter.

An ordinary exposure meter cannot be used effectively on the enlarger because firstly it is not sufficiently sensitive and secondly its design is such that generally the meter cannot be read when placed flat on the enlarger baseboard with the photo-cell facing the lens.

The Majosix is a specially designed instrument, comprising a very sensitive micro-ammeter with a large scale, very accurately calibrated direct in exposures from 0.6 to 120 seconds, and a separate photo-cell which can be placed flat on the baseboard so that the surface of the cell is less than ½-in. above it. The full size of the acceptance surface of the photo-cell is 1½-ins. diameter and the sensitivity of the instrument can be judged from the fact that with the full area of the cell in use exposures as long as 2 minutes with bromide paper of normal speed can be measured.

In order to enable small special areas of the image to be measured, a swing-out diaphragm is provided which reduces the diameter of the acceptance circle to about ½-in. This, of course, reduces the sensitivity to one-tenth, so that the maximum exposure which can be measured is 12 seconds.

In designing the instrument the manufacturers had prominently in mind its application to colour printing, and one special refinement has been provided to facilitate working with colour materials, the speeds of which do not vary widely from the normal; this comprises a seven-point switch which changes the sensitivity of the instrument in three steps on either side of the normal, giving direct reading for paper speeds -30, -20, -10, $+10$, $+20$ and $+30$ per cent. from normal. Although our tests gave correct readings for a standard normal grade of bromide paper, the makers do not suggest the use of this switch for black-and-white work, since bromide paper varies in speed within wider limits.

Another refinement which, whilst it is extremely useful for bromide printing, is essential for the darkroom conditions when colour printing, is a self-contained, adjustable lamp which illuminates the meter scale. This lamp is operated from a built-in transformer and for colour work a special safelight is provided which renders the light safe for colour materials. The price of the Majosix enlarging exposure meter is £33 plus £10 14s. 6d. purchase tax.

PRODOX DEVELOPER

(May and Baker Ltd., Dagenham, Essex)

Prodox is a standard type of high contrast developer of the two-solution, hydroquinone-caustic formulation. It is designed primarily for use in graphic arts work where maximum contrast is needed in line and half-tone negatives, but there is naturally no reason why it should not be used for general photographic work when a high contrast result is needed.

The developer is supplied in a pack to make one gallon of working solution. The card outer packing contains the chemicals in two polythene bags, one containing the caustic and the other the developing agent and other components. The two components are dissolved in separate bottles of half gallon capacity and equal parts of each are mixed immediately before use. As one would expect of a developer using hydroquinone, Prodox must not be used at a lower working temperature than 60° F.

The polythene bags used for the packing protect the two components completely and the developer is completely immune from damage through climatic changes. The price of the one-gallon pack of Prodox is 6s.

FLASHOLDER MODEL II and FLASHPACK

(Kodak Limited, Kodak House, Kingsway, London, W.C.2)

This new model of the Kodak Flasholder is radically different in design from its predecessor and incorporates one or two ingenious features not hitherto seen in comparable apparatus. The unit is designed around a smartly styled black plastic battery case which is large enough to hold two U.11 unit cells. The front of the casing is rounded and ribbed so that it may be gripped easily and firmly and an open-flash firing button is so placed that it may be used without difficulty when the unit is gripped normally in the hand.

A 5-in. reflector is fitted at the upper end of the battery casing, concentrically mounted with respect to the lampholder. A transparent plastic diffuser which has a series of small concentric ribs moulded into the central area is firmly fitted to the reflector and can be swung to one side in order to insert the bulbs. The diffuser is slightly bowl-shaped so that any type of lamp with an A.S.C.C. cap may be used, even those with a long bulb such as the German Osram XO. A simple bulb ejector is also fitted.

The connecting lead from the flash unit to the camera shutter is interchangeable and supplied separately; two types are available, one for standard pattern connections of the Compur type and the other for two-pin connectors such as those fitted to the Six-20 Brownie Model D.

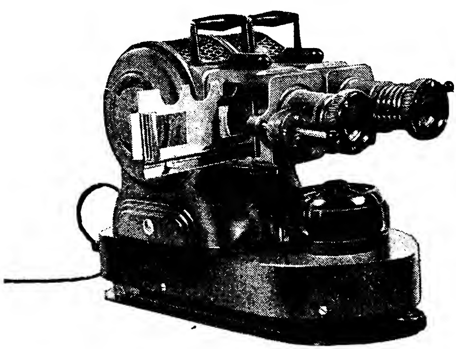
The bottom of the body of the unit is tapped with the ¼-in. standard tripod bush thread, and this bush has a circular area of serrations surrounding it; the camera bracket, which is provided with three positions, into which the clamping screw may be fitted, has a rubber washer which mates with these serrations and firmly grips the flash unit in proper position. The three positions enable a wide range of cameras to be used with the flash unit and the bracket is finished in grey metallic enamel.

The Flashpack is a neat unit consisting of a holder for a 22½-volt deaf-aid battery and a chassis which carries a capacitor and resistor. This unit fits into the Flasholder in place of the two unit cells and neatly converts the flashgun into a battery-capacitor type, without need for any further modification. The price of the basic Flasholder is £1 1s. plus 6s. 11d. purchase tax. The Flashpack costs 8s. plus 2s. 7d. purchase tax. The camera bracket costs 5s. plus 1s. 8d. purchase tax, and the connecting cables 6s. plus 1s. 11d. purchase tax.

VERASCOPE STEREOSCOPIC DUAL PROJECTOR

(Photo-Science Ltd., 10 North End Parade, West Kensington, London, W.14)

This projector is in effect a pair of slide projectors of standard design mounted side by side and is intended as a companion piece of equipment to the Verascope F40 stereo camera. The projector is extremely solidly made, the main components being die castings; at the front of the base, is mounted the motor of the fan which provides the forced draught cooling for the two 400-watt lamps. The twin lamphouse, which is mounted at the back of the base, is of somewhat novel shape and carries the twin lens assembly and the slide carrier.



The base of the projector is a hollow casting which carries at its forward end, internally, the cooling fan. The intake for this is on the underside and the whole projector is mounted on a sub-base which lifts the main casting about ½-in. from the table and allows ingress of air. A milled disc at the extreme front of the base provides levelling adjustment.

The two lamps are provided with independent switches at the back of the lamphouse so that the two images may be individually focussed or the unit used for projection of single slides.

The holder for the slide carrier is mounted on the forward side of the lamphouse and this again is a light alloy die-casting which also carries the twin condenser assemblies. On the front of this casting is carried the projector lens mount in which is incorporated a rather novel feature which enables the images to be correctly positioned on the screen. The lens mount is held in the slide holder casting in such a way that it is free to move through a small distance either horizontally or vertically. At the side of the mount is a rod which has at its outer end a small knob; the rod is fitted into the main casting with a universal joint and a second universal joint links it with the lens mount casting, as can be seen in the illustration. When the rod is moved either up, down or sideways by its knob, the lens mount follows suit; thus with both lamps switched on and whilst the operator is not wearing polarising glasses, the two images on the screen can be correctly placed for both vertical and horizontal register.

The projector can be used for stereo slides in the Verascope format or for the slightly smaller American standard size slides; carriers for two slides in both sizes are available.

The two projection lenses are matched and are capable of being focussed individually and are adjusted by rotation of the mount. The two polarising filters are carried in a removable slide behind the lenses and just in front of the slide carrier.

The projector is finished in a light brown wrinkle finish enamel with the carriers for the slides finished in matt chrome. The price of the Verascope stereo projector is £160.

DAYLIGHT PROJECTION SCREENS

(Vivalux Regenerative Screens Limited, 84 Avenue Chambers, 4 Vernon Place, Southampton Row, London, W.C.1)

These screens are designed for the projection of still transparencies or cine film in conditions of full daylight. The screens are essentially back projection screens but a right-way-round picture is obtained by the use of a 45° internal mirror; the axis of the projector lens is thus at 90° to the axis of the screen. Thus described there would seem to be little that is remarkable in these screens, but in fact they represent a distinct step forward in the design of such equipment. The screen is mounted on the front of the unit and is quite free from such aids as side screens and hoods to mask off the general illumination from the front surface of the screen.

From the front with no picture being projected upon it the screen appears a dead black but with even the most modest projector power a bright picture with excellent tonal gradation is obtained. A viewing angle of 60° is claimed and it could well be said that this claim is distinctly on the conservative side; certainly at the limits of such a viewing angle the brightness of the picture is little if any less than when the screen is viewed directly. The brightness of the picture is virtually unaffected by the prevailing lighting conditions in the room in which the screen is used although care must naturally be taken that light cannot fall on the screen from the back by means of the mirror.

Two sizes of the screen are available. The Salesmaster is an easily portable unit designed for travellers and window display with a screen width of 16-in. When closed for carrying the size of this unit is $18 \times 16 \times 10$-in. and the screen itself is protected by a pair of doors. To put the screen into use the two front doors are opened and the back of the case swung out to an angle of 45°. This latter action automatically opens a screening hood which joins the back of the cabinet and the mirror and provides a short tunnel through which the projection beam passes.

The Classmaster is a somewhat larger unit designed for use in the classroom, hospital or factory, giving a picture of maximum width of 24-in. The dimensions of this unit when closed for carrying are $26 \times 20 \times 11$-in.

The prices of these two efficient and ingenious screens are £15 15s. for the Salesmaster and £21 for the Classmaster.

SYNCROLITE ELECTRONIC FLASHGUN

(Johnsons of Hendon Ltd., Hendon Way, London, N.W.4)

The Syncrolite flashgun is an extremely efficient electronic outfit with the essential components designed into a reasonably small compass. The flash head consists of a moulded, black plastic body which measures $1\frac{7}{8} \times 1\frac{1}{4} \times 4$-in. which carries at its upper end a $5\frac{1}{2}$-in. reflector. The inner surface of the reflector is matt finished and is anodised so that this high reflectance diffuser will retain its efficiency.

The low voltage flash tube is mounted directly into the body of the flash head and is covered with a transparent moulded plastic cover. An on-off switch is provided on the side of the flash head and a foot which fits into the standard camera shoe. A camera bracket can be supplied for those users who prefer this. An indicator neon and an open-flash operating button are fitted to the back of the flash head, and the synchronising lead, which is fitted with the standard Compur type plug, is permanently attached to the head.

The power pack is contained within a leather case on a shoulder sling, the case measuring $7 \times 4\frac{1}{2} \times 2$-in., little bigger than the normal carrying case for a 120 folding camera.

The case contains the capacitor and the battery pack, the latter consisting of eight 30-volt deaf-aid batteries. These eight batteries are contained within a paxolin outer container which is fitted with a non-reversible two-pin socket at its upper end. The eight batteries are placed in the outer container in accordance with the diagram printed on its side to ensure correct polarity and series connection of the individual 30-volt units.

The head is attached to the power pack by 3-ft. of cable and can be stowed on the back of the leather case of the pack when not in use.

The unit is rated at 25 joules and a flash factor of 80 to 120 is suggested for high-speed panchromatic films. Tests show that this rating can be used with confidence and the evenness of illumination given by the reflector is good. The batteries are stated to be capable of giving 750 flashes over a period of six months and the tube life is given as 25,000 flashes. The duration of the flash is 1/1,000 sec. The price of the Syncrolite is £10 10s. plus £3 8s. 3d. purchase tax.

CHEMICALS

Properties of Chief Chemicals used in Photography.

On these pages are given particulars of just those chemicals which are used in everyday photography, with those of a few others not so regularly employed. The facts here collected are those which it is useful to know for the proper making-up of solutions: and they also enable photographers unacquainted with chemistry to identify chemicals by their different names. A few of the uses of some of the chemicals are briefly stated, in brackets, at the end of each paragraph.

Acetic acid CH_3COOH.—The glacial acid—sp. gr. 1.055—is usually specified in photography. Soluble in all proportions in water, alcohol, ether and chloroform. Dissolves gelatine, oils and fats. Solidifies at 50 deg. F. American formulæ often specify the dilute acid of 28 to 31 per cent. strength. (Acidifying fixing baths, acetate film cements.)

Albumen.—Typical albumen occurs in white of egg. which may be used for preparation of sensitisers, etc., but prepared dry albumen is more convenient on account of its good keeping properties.

Alcohol.—Ordinary alcohol is ethyl alcohol (ethanol) C_2H_5OH, which when of sp. gr. 0.794 is " absolute " (=100 per cent.). Alcohol containing 10 per cent. of water is " rectified spirit ". Methylated spirit is rectified spirit plus 10 per cent. crude wood spirit, one eighth per cent. mineral naphtha, ½ to 1 per cent. pyridine and methyl violet to colour it. Milkiness which occurs when the spirit is mixed with water is due to the naphtha. (Concentrated developers, rapid drying, cleaning, solvent for shellac, mastic, sandarac and dammar.)

Alum.—General name for double sulphate of aluminium and potassium (or ammonium). Potassium alum $K_2SO_4Al_2(SO_4)_3.24H_2O$ is the photographic variety which is sold in large white crystals or in powder form which is more easily dissolved. Solubility 1 in 10 in cold water. An acid substance decomposing hypo with deposition of sulphur. It should be free from iron, a trace of which may cause bluish stains on sulphide toned prints. (Hardening bath.)

Amidol.—Diaminophenol hydrochloride, $C_6H_3OH.(NH_2)_2.2HCl$, Fine white or bluish grey crystals, very soluble in water. Almost insoluble in alcohol. Developers are prepared by dissolving amidol in a solution of sodium sulphite. Both dry and in solution it should be stored in well stoppered amber bottles. Neutral or mildly alkaline solutions soon lose activity, but weak acid solutions keep much better.

Ammonia.—Strong solution of the gas NH_3 in water. The gas combines with water to form partly or completely ammonium hydroxide thus: $NH_3+H_2O=NH_4OH$. Strong solution of ammonia should be of specific gravity 0.880 in which form it gradually loses its strength. 0.880 ammonia solution contains approximately 35 per cent. by weight of NH_3.

Ammonium bichromate $(NH_4)_2\ Cr_2O_7$.—Orange crystals, more soluble than the potassium salt. Solubility 1 in 4 in cold water. Used as a sensitiser in photomechanical process work with albumen. It may replace the potassium salt as a gelatine sensitiser in the carbon, carbro and oil processes.

Ammonium bromide, NH_4Br. White crystalline powder dissolving in 1½ times its weight in cold water; slightly soluble in alcohol. Absorbs moisture and should be kept well stoppered.

Ammonium carbonate $NH_4HCO_3+NH_2.CO.ONH_4$. Also known as Rock Ammonia. Sold in hard opaque pieces or cubes. Solubility 1 in 4 in cold water; should not be dissolved in hot water.

Ammonium chloride, NH_4Cl. Fine white powdery crystals. Solubility 1 in 3 in cold water, in 1½ hot water. Should be kept well stoppered. (Rapid fixing baths.)

Ammonium persulphate, $(NH_4)_2S_2O_8$. Small white crystals, soluble 1 in 1½ in cold water. Decomposed by hot water. The crystals rapidly absorb moisture and must be kept well stoppered. (Reducing.)

Ammonium thiocyanate, NH_4CNS, also called ammonium sulphocyanide. Small white crystals which are very deliquescent. Wet crystals cannot be dried and are useless. Very soluble in water and alcohol. (Toning P.O.P.; developers for reversal process.)

Borax, sodium tetraborate, $Na_2B_4O_7$. $10H_2O$. White crystalline powder. Solubility 1 in 12½ in cold water, much more soluble in hot water. Due to presence of unneutralised anhydride borax constitutes a natural self-contained buffer maintaining a pH of 9.2 at a wide range of concentrations. (Weak alkali for fine-grain developers.)

Boric acid, ortho boric acid, H_3BO_3. Solubility 1 in 29 in cold water; 1 in 2.9 in hot water. Both crystals and powder are available, the former being more easily dissolved. As a buffer with borax it is used to control the alkalinity of certain fine-grain developers. Boric acid also forms a component of acid fixing baths.

Calcium chloride, $CaCl_2$. The commercial fused form is an active desiccant. It can be re-activated by heating in an iron shovel or tray. Used to protect ferroprussiate papers from deterioration by moisture.

Calgon.—Essentially sodium hexametaphosphate, $Na_2(Na_4P_6O_{18})$, but with a small addition of alkaline phosphate to reduce slight acidity. Solvent of otherwise insoluble calcium and magnesium salts which are precipitated by alkalis in tap water. Used for obtaining clear solutions of alkaline developers.

Caustic potash, correctly potassium hydroxide, KOH, sometimes called potassium hydrate. The purest form used in photography is sold in sticks or pellets. Rapidly becomes moist when exposed to air and should be stored in well corked. not stoppered bottles. Dissolves in half its weight of water with production of much heat, for which reason solutions should be made in enamelled or stainless metal (not aluminium) vessels. Caustic solutions should be rubber stoppered. Used as a powerful energiser for slow reducers such as hydroquinone. Used also for preparing concentrated phenolate developers. See caustic soda.

Caustic soda, sodium hydroxide, $NaOH$. Slightly less powerful than caustic potash, but similar in other respects and requires the same precautions. The stick form is generally used in photography. It is cheaper than caustic potash and may replace the latter provided the equivalent weight is used. The two equivalents are: Caustic soda 40, caustic potash 56. For removing gelatine from waste negatives the commercial or scouring grade may be used.

Chlorquinol, monochlorhydroquinone, adurol (Hauff) $C_6H_3Cl(OH)_2$. A white or slightly tinted crystalline powder readily soluble in water, also in alcohol. More energetic than hydroquinone, and less sensitive to temperature.

Chrome alum, double sulphate of chromium and potassium (or ammonium), K_2SO_4. $Cr_2(SO_4)_3$. $24H_2O$. Forms violet crystals, appearing ruby red by transmitted light. Slowly soluble 1 in 10 in cold water, decomposes in hot water which should not be used. Solution is aided by grinding crystals to a fine powder. Valuable hardener of gelatine which action is increased by adding a few drops of ammonia to give very slight alkalinity. (Stop baths and hardener in fixing baths.)

Citric acid, C_3H_4 (OH) $(COOH)_2$. Small colourless crystals, or sticky caking powder. Forms complex compounds with many basic salts which it dissolves. (Acid fixing baths; preservative for developing agents in sulphite solutions; dish cleaner.)

Copper sulphate, blue vitriol, $CuSO_4$. $5H_2O$. Blue crystals. Solubility 1 in 2½ in cold water. The photographic quality should be pure and free from iron. Must be kept well stoppered. (Bleacher; reducer.)

Dextrine.—British gum. For mountants it should be of the purest quality. See formulæ Section under Mountants.

Ferric ammonium citrate, iron and ammonium citrate. Forms the basic sensitiser in ferroprussiate papers, for which purpose only the green scales are used. Very soluble in water and forms into a sticky mass when exposed to air. Keep well stoppered and shielded from light.

Ferric chloride, $FeCl_3$. $6H_2O$, iron perchloride. Occurs as a yellow or mustard coloured mass; actually crystalline, but appears as amorphous lumps. Light-sensitive and used for ferroprussiate papers; also for etching on copper in photo-engraving. Keep well stoppered and shielded from bright light.

Ferric oxalate, $Fe_2(C_2O_4)_3$. Occurs in soluble green scales or flakes. More sensitive to light than ferric chloride and oxalic acid combined, and replaces them with the production of better blue in ferroprussiate papers. The double iron oxalates of iron and sodium (also potassium and ammonium) are used for the same purpose.

Formalin, 40 per cent. solution of formic aldehyde H.CHO. Water soluble in all proportions. It is pungent and irritating, and is slightly acid. (Hardener and preservative.)

Gelatine is not a definite chemical compound, but a mixture of colloid substances. It swells in cold water, dissolves when the swollen mass is heated and sets to a jelly when cool. Gelatine is dissolved in the cold by oxalic, hydrochloric, acetic and nitric acids. Mixed with the last-named it forms a glue, and with acetic acid it is a celluloid cement. Alum, formalin and tannic acid harden gelatine, rendering it insoluble and incapable of swelling in water.

Glycerine, glycerol, $C_3H_5(OH)_3$. A colourless syrupy liquid, sp. gr. 1.265. Miscible with water and alcohol in all proportions. At ordinary temperatures glycerine does not evaporate, but absorbs water from the air. A glycerine solution will give suppleness to gelatine coated films and papers which are liable to crack due to excessive drying. After evaporation of the water a trace of glycerine remains in the emulsion coating.

Glycin, para - hydroxyphenylamino - acetic acid, $C_6H_4OH.(NH.CH_2COOH)$. White or cream-coloured powder. Slightly soluble in water, but readily so in alkaline solution; almost insoluble in alcohol. Not to be confused with " glycine " which is amino acetic acid and photographically inert.

Gold chloride.—The yellow crystals commonly sold in Britain are a compound of gold chloride and sodium chloride—$NaAuCl_4.2H_2O$—there being 7½ grains of metal in 15 grains of the chloride. Brown crystals—$HAuCl_4.3H_2O$—contain half their weight in metal. (Toning.)

Hydrochloric acid, muriatic acid. A solution of HCl gas in water. The pure commercial acid of sp. gr. 1.16 dissolves the oxides and carbonates of most metals. " Spirits of salt," a crude form containing iron, etc., is a useful cleaner of glass and porcelain vessels containing mineral deposits, etc. Use with great care.

Hydrofluoric acid.—Fuming and highly corrosive solution of the gas HF in water. Commercially sold at 60 per cent. strength. Must be kept in gutta-percha bottles. It is a solvent of glass and is used as a film stripper and solvent etch. Extremely dangerous if allowed to come in contact with the skin.

Hydroquinone.—Quinol, hydrokinone, hydrochinon, correctly para-dihydroxybenzene, $C_6H_4(OH)_2$. Fine white needle crystals. Solubility 1 in 18 in cold water, more so in hot water. Soluble in rectified spirit. (Low energy developer.)

Hypo, sodium thiosulphate, $Na_2S_2O_3.5H_2O$, incorrectly called sodium hyposulphite. Occurs as pea crystals or larger hexagonal crystals. Extremely soluble in water to the extent of nearly its own weight. Chilling of the solution is compensated by using hot water when dissolving hypo. Strong acids and acid salts liberate sulphurous acid or sulphur dioxide with deposition of sulphur due to decomposition. Sulphurous acid and its acid salts (potassium metabisulphite and sodium bisulphite) do not react in this way, and with hypo will form a stable acid bath. Hypo is a rapid solvent of silver bromide and chloride, and to a less extent of silver iodide. It is also obtainable in an anhydrous powder which dissolves more rapidly than crystals. In fixing baths, three parts of dry hypo are equivalent to about five parts of the crystals.

Iodine, I.—Greyish violet flakes or plates of metallic lustre. It is insoluble in water, but soluble in alcohol and in a solution of potassium iodide. With starch, iodine forms an intensely blue compound (iodide of starch), the colour of which is bleached by a small quantity of hypo. In this way iodide of starch may be used as an indicator of the presence of hypo in washing water. Iodine solution is decolourised by hypo.

Kodalk.—A proprietary alkali recently introduced. It is less alkaline than sodium carbonate, but more so than borax, compared with which it is more soluble. Unlike carbonate it does not liberate CO_2 gas when passed in to acid baths, consequently there is less possibility of blistering the emulsion in hot weather. It is suitable for tropical developers, and may replace borax for a number of purposes.

Lead acetate, sugar of lead, $Pb(CH_3COO)_2$. $3H_2O$. Clear white crystals. Solubility 1 in 1½ in cold water. Hot water should not be used. Milkiness in solution is due to formation of lead chloride, carbonate or sulphate caused by tap water. (Toning.)

Liver of sulphur. potassium sulphide. Contains small quantities of sulphate and carbonate of soda, hypo and polysulphide compounds. Sold in reddish brown pieces. Very soluble in water. (Silver recovery; toning.)

Mercuric iodide, bi-iodide of mercury, HgI_2. Bright red powder insoluble in water; readily soluble in sodium sulphite, hypo and potassium iodide. Intensely poisonous. (Lumière intensifier.)

Mercuric chloride, bichloride or perchloride of mercury, $HgCl_2$. In heavy pieces or crystalline powder. Solubility 1 in 16 in cold water, but more readily in boiling water. Solubility is increased with added hydrochloric acid or ammonium chloride. The solution is intensely poisonous and must not come into contact with broken skin. (Intensifier.)

Meritol.—A patented developing agent, understood to be paraphenylenediamine pyrocatecholate, $C_6H_4(NH_2)_2$. $C_6H_4(OH)_2$, a cream or greyish crystalline substance sparingly soluble in cold water, but more so in a warm solution of sodium sulphite. As a fine-grain developer it is claimed to have advantages over paraphenylenediamine.

Methyl alcohol, CH_3OH, methanol. Sp. gr. 0.81. The chief constituent of " wood spirit " or wood naphtha which contains acetone and other impurities. With care may be used to dry celluloid films. Solvent.)

Metol, mono-methyl-paraminophenol sulphate, $OH.C_6H_4(NH.CH_3)$, $1/2H_2SO_4$. White crystalline powder. Metol dissolves with some difficulty in sulphite solution. Hence, in making up developers, the metol should be dissolved with only a small portion of the sulphite.

Nitric acid.—Strongly corrosive liquid. Commercial strong pure acid of sp. gr. 1.42 contains 71 per cent. of HNO_3. Oxidises alcohol and other organic solvents. Burns skin and clothes.

Paraminophenol (base), NH_2. C_6H_4OH. Yellowish-white crystalline powder. Very slightly soluble in cold water, but more freely in hot water. The hydrochloride is generally used because of its greater solubility and better keeping properties. Forms a phenolate with caustic alkalis, permitting a high concentration of the base or salt.

Paraphenylenediamine (base), $C_6H_4(NH_2)_2$. Yellowish-white to dark brown crystals. Much less soluble than the hydrochloride. Used either alone or with glycin and/or metol with or without alkali.

Potassium bichromate, more correctly dichromate, $K_2Cr_2O_7$. Large orange-red crystals. Solubility 1 in 14 in cold water; soluble in own weight in hot water. An acidified solution is a powerful oxidising agent. (Bleacher in reversal and intensifying processes; gelatine and albumen sensitiser; cleaner.)

Potassium bromide, KBr. Small colourless crystals. Solubility 1 in 1½ in cold water and in own weight in hot water. (Restrainer and re-halogeniser.)

Potassium carbonate, carbonate of potash, K_2CO_2. Known also as potash. White anhydrous (dry) deliquescent powder. Dissolves in less than its own weight of water. The so-called crystalline variety is of uncertain composition. (Developers; rapid drying of negatives.)

Potassium chloroplatinite, proto-chloride of platinum and potassium, K_2PtCl_4. Small red crystals. Solubility 1 in 6 in cold water; insoluble in alcohol. The salt should contain 46 per cent. of platinum metal. Distilled water should be used for solution to which is added one drop of hydrochloric acid. Must be kept in well stoppered bottles. (Platinum toning.)

Potassium cyanide, cyanide of potash, KCN. The commercial variety is sold as hard white pieces (fused) containing 30 to 40 per cent. KCN. The pure substance, however, contains at least 90 per cent. KCN. A double salt which contains 98 to 100 per cent. KCN is available which may replace the potassium salt, but the actual strength must be taken into consideration when making up the Monckhoven intensifier. Very soluble in water and alcohol, potassium cyanide is extremely poisonous and rapidly absorbed in skin abrasions, cuts, etc. Dangerous prussic acid vapour results from the action of an acid on solid cyanide or its solution. Cyanide is a powerful solvent of the silver halides, and has perceptible solvent action on the developed image. (Local reducer.)

Potassium ferricyanide, red prussiate of potash, $K_3Fe(CN)_6$. Deep ruby red crystals, often with slight reddish coating which may be removed by rinsing. Solubility 1 in 2½ in cold water. Ferricyanide solution keeps better combined with some common salt. (Reducer; bleacher; ingredient in ferroprussiate sensitisers.)

Potassium iodide, iodide of potash, KI. Small white crystals dissolving in less than their weight of water. Slightly soluble in alcohol. Colour changes slightly to yellow in light, but is no detriment to its use as a solvent of iodine in intensifiers.

Potassium metabisulphite, $K_2S_2O_5$. White transparent crystals usually slightly incrusted, rendering them opaque. Should be kept well sealed to prevent deterioration. Fairly soluble in cold water forming sulphite and sulphurous acid. Partly decomposed by hot water which should not be used. (Acidifying fixing baths; preservative and buffer in developers.)

Potassium permanganate, permanganate of potash, $KMnO_4$. Small black crystals with a bronze lustre. Solubility 1 in 16 in cold water; readily soluble in hot water. Heavy stain caused by its solution can be discharged by a solution of sodium or potassium metabisulphite or oxalic acid. Powerful oxidiser, but useless when reduction turns it brown. (Stain remover; bleacher; disinfectant; deodorant.)

Potassium thiocyanate, potassium sulphocyanide or sulphocyanate, KCNS. Small white deliquescent crystals, very soluble in water. More stable than the ammonium salt, especially in the presence of alkalis. Used as a silver halide solvent in fine-grain and reversal developers.

Pyrocatechin, catechol, $C_6H_4(OH)_2$, correctly ortho-dihydroxybenzene. White crystalline, very soluble substance, less energetic than hydroquinone. Has many applications. In conjunction with a caustic alkali and highly diluted it forms a fine-grain developer. With sodium carbonate it gives sepia to red tones to chlorobromide papers. Used highly diluted, also with carbonate or a caustic alkali it ranks with metol and paraminophenol as a surface-acting developer suitable for under-exposed negatives. Pyro-catechin combined with sodium carbonate, but with little or no sulphite constitutes a tanning or hardening developer. A negative so developed and treated with hot water will yield a relief image capable of being selectively dyed.

Pyrogallic Acid, pyro, pyrogallol, $C_6H_3(OH)_3$, correctly 1-2-3-trihydroxybenzene. Obtainable as white feathery sublimed crystals or as normal crystals of about 1/10th the sublimed bulk. The two forms are identical in composition and are extremely soluble in water and alcohol. Pyro oxidises rapidly in solution unless preserved in normal or acid sulphites. Pyro should always be added after the preservatives have been dissolved. Valuable as a fog inhibitor in conjunction with other developers.

Silver nitrate, lunar caustic, $AgNO_3$. Solubility 2 in 1 in water. Chlorides in tap water cause milkiness, hence always use distilled water. Black or brown stains on fingers or clothes can be removed by tincture of iodine followed by strong hypo.

Sodium bicarbonate, bicarbonate of soda, $NaHCO_3$. Fine white powder. Solubility 1 in 11.3 in cold water. Feebly alkaline, and decomposed by hot water.

Sodium bisulphite, $NaHSO_3$. Obtained as a fine white powder, but the lye or liquid of average density 36 deg. Baumé (=1.33 sp. gr.) is more stable. This colourless or pale yellow liquor can be used instead of sodium sulphite, although its acidity must be taken into consideration. Sodium bisulphite or metabisulphite may replace potassium metabisulphite in the same proportions.

Sodium bromide, NaBr. White crystals or granular powder. Slightly deliquescent. Solubility 1 in 1.5 in cold water. (Restrainer.)

Sodium carbonate, carbonate of soda. Two forms are commonly available, crystalline, $Na_2CO_3 . 10H_2O$, and anhydrous, Na_2CO_3. The latter is known also as " dry " and in pharmacy as " exsiccated ", the American equivalent being " desiccated ". To convert crystals to the anhydrous equivalent multiply by 0.371. To convert the anhydrous to the crystal equivalent multiply by 2.7. Crystalline carbonate is contaminated by air and should be kept well sealed; solubility 1 in 1.5 in cold water. Anhydrous carbonate absorbs moisture from air and should also be well sealed; solubility 1 in 6 in cold water.

Sodium metabisulphite, $Na_2S_2O_5$. Similar in most respects to the potassium salt which it may replace. The crystal form is more suitable than the powder.

Sodium sulphide, $Na_2S.\ 9H_2O$. When pure is in small colourless deliquescent crystals. Dilute sulphide solution rapidly oxidises and for this reason a 20 per cent. stock solution should be available for dilution to working strength just prior to use. The fumes have a deleterious effect on unexposed sensitive materials, and solutions should be quickly washed down the sink after use. The commercial quality is used to precipitate silver residues in solution.

Sodium sulphate, sulphate of soda, Glauber's salt, $Na_2SO_4.\ 10H_2O$. Large transparent efflorescent crystals, 2½ parts of which are equal to one part of the anhydrous salt. Prevents swelling of the gelatine in alkaline solution, hence its use in tropical developers. Solubility 1 in 3 in cold water, more so in hot water up to 90 deg. F., beyond which solubility becomes less.

Sodium sulphite, sulphite of soda, $Na_2SO_3.\ 7H_2O$. Large clear efflorescent crystals. Solubility 1 in 2 in cold water; maximum solubility at 100 deg. F. The crystals oxidise in air to sulphate indicated by powdery coating, which should be removed by rinsing before use. Two parts of the crystals are equal to one part of the anhydrous salt which is more easily soluble. Sulphite solution rapidly oxidises, and in doing so loses its power as a preservative. In developers this is retarded by preserving the reducer with an acidified sulphite solution, in which case the alkali is kept as a separate solution. Sodium sulphite is a solvent of the silver halides which explains its high concentration (100 grams or more of the dry salt per litre) in certain fine-grain developers.

Sodium tribasic phosphate, tri-sodium phosphate, $Na_3PO_4.\ 12H_2O$. White crystals, very soluble in water. More active than sodium carbonate and used in conjunction with paraphenylenediamine and glycin. It is also obtainable in a dry form; containing one molecule of water.

Sulphuric acid, oil of vitriol, H_2SO_4. Syrupy, highly corrosive heavy liquid, of sp. gr. 1.84, containing 98 per cent. of the real acid. In preparing solutions, the acid must always be added slowly to the water. If water is added to the acid the great heat developed may crack the vessel and throw out the contents with explosive violence. (Reversal baths.)

Tannic acid.—A yellowish or light brown powder, very soluble in hot water. It is of uncertain composition, but the pharmaceutical quality is most suitable for photographic use. Tannic acid solution is miscible with chrome alum solution and formalin separately, but incompatible with both together. (Hardener.)

GLOSSARY

OF CHEMICAL AND TECHNICAL TERMS USED IN PHOTOGRAPHY

Absorption.—Imbibition. The capacity of a substance to hold fluids. To saturate. In respect of light, such wave-lengths as are detained in the absorbing medium and thus are not reflected or transmitted. In spectra, where black lines give evidence that colours have been absorbed by the transmitting medium.

Accelerator.—The alkali energiser in a developer, the velocity of which it controls. Alkalinity is a function of hydroxyl concentration and the extent to which such free ions combine with the developing agent to form more freely hydrolysed salts.

Acids.—Substances which increase the hydrogen ion concentration of water. More or less corrosive according to the degree of ionisation.

Acyl.—Common term for univalent group remaining after hydroxyl radicle has been removed from a carboxylic acid. Thus in acetic acid CH_3COOH, the acyl group CH_3CO. is particularised as acetyl. Similarly the benzoyl group C_6H_5CO. is the acyl group of benzoic acid. Reaction involving the introduction of an acyl group is termed acylation, *e.g.* acetyl chloride $CH_3CO.Cl + NH_3$ ammonia = $CH_3CO.NH_2$ acetamide + HCl.

Adsorption.—Phenomenon which occurs at the boundary or interface between two phases held together by physical attraction. The participating phases may form an intermingled layer of different chemical and physical constitution. Ions in solution may be so adsorbed on the surface of a crystal as in the case of sensitising dyes.

Aldehydes.—Literally alcohol dehydrogenation. Substances obtained by oxidation of a primary alcohol. Thus ethyl alcohol $C_2H_5OH + O =$ CH_3CHO acetaldehyde + H_2O. The group —C being characteristic of aldehydes. See Ketones.

Aliphatic Compounds.—Structurally those in which the carbon atoms appear as open chains as distinct from closed rings. Including the fats and fatty acids, also alcohols and esters, etc. Aliphatic radicles are usually alkyl and denoted by " R " in formulæ.

Alkalis. Substances which increase the hydroxyl (OH) concentration. They are essentially soluble, as for example NaOH and KOH. Insoluble bases and basic oxides are not alkalis. Accelerators or energisers in developers.

Alkyl.—Univalent group remaining when an atom of hydrogen is removed from a paraffin hydrocarbon. Thus CH_3 and C_2H_5 are the alkyl radicles of methane CH_4 and ethane C_2H_6 respectively.

Amides.—Substituted ammonias in which 1, 2 or 3 hydrogen atoms in ammonia are replaced by an acid radicle which supplies the name prefix of the particular amide. Thus in mono-substituted acetamide the reactants are acetyl chloride and ammonia : $CH_3CO.Cl + NH_3 = CH_3CO.NH_2 + HCl$. Di- and tri- acetamides are also obtained.

Amines.—Substituted ammonias in which 1, 2 or 3 hydrogen atoms of NH_3 are replaced by univalent hydrocarbon radicles giving rise to primary, secondary and tertiary amines respectively. Trimethylamine $(CH_3)_3N$ is a typical aliphatic amine, whilst aniline (aminobenzene or phenylamine) is a primary aromatic (ring substituted) amine. Tetra substitutions supposedly involving ammonium radicle (NH_4) give rise to quaternary ammonium compounds in which nitrogen is pentavalent as in teramethyl ammonium iodide $(CH_3)_4N.I$ or

$$\left.\begin{matrix} CH_3 \\ CH_3 \\ CH_3 \end{matrix}\right\rangle N <\begin{matrix} CH_3 \\ I \end{matrix}$$ See Quaternary.

Anhydride.—Molecule remaining when water is removed from an oxy-acid. Sulphurous acid deprived of its water molecule is sulphur dioxide or sulphurous anhydride, *i.e.* $H_2SO_3 - H_2O = SO_2$.

Anhydrous.—Dry. Exsiccated. Desiccated. Not containing water. Crystalline salts deprived of water molecules.

Aralkyl.—Denotes an aryl-alkyl compound in which the aryl group is joined to an alkyl group. The latter then forms a chain substituent in a benzene ring.

Aromatic Compounds.—Generally accepted to mean benzene and its derivatives.

Aryl.—Group remaining when one hydrogen atom has been removed from an aromatic hydrocarbon. Thus the phenyl group C_6H_5- is an aryl radicle and aniline or phenylamine $C_6H_5.NH_2$ is therefore an arylamine.

Base.—Substances containing OH or O groups capable of combining with an acid to form a salt and water only. Basic oxides and hydroxides. Also the support of any nature on which a sensitive emulsion is coated or applied.

Binder.—The protective colloid which holds or binds precipitated silver halides in a sensitive emulsion. Commonly gelatine, but the term now includes other substances such as polyvinyl and cellulose derivatives as alternatives. Many of these water-soluble and water-swellable substances are patented.

Buffering.—A means of controlling acidity or alkalinity of a hydrolised salt to some desired pH value against which standard buffer solutions the colour changes of indicators may be checked. Buffering is only possible with salts resulting from incomplete neutralisation as in the case of a weak acid and strong base (or vice versa). An example is borax to which is added more boric acid as a further step towards complete neutralisation. The result is a decrease in alkalinity. Apart from a capacity to resist changes in pH, buffer solutions can be compounded to give a continuously variable range of pH values between the limits of acidity and alkalinity of the buffer components. See Neutralisation.

Carbonyl.—$> C = O$ group characteristic of both aldehydes and ketones, which see.

Carboxyl.—COOH group or radicle characteristic of organic acids as in acetic acid CH_3COOH, benzoic acid C_6H_5COOH, etc.

Characteristic Curve.—Synonymous with H and D Curve and Density/Log. E Curve. A graphical representation of a series of specifically graded densities which are plotted against the logarithms of the exposure values producing them. Exposure values are the product of Intensity and Time (IT), where I is constant and T progresses (geometrically) by multiples of 2. The Curve is for the most part an inclined straight line lying between a lower foot or toe and a higher shoulder representing the under-exposure and over-exposure regions respectively. See H and D and Exposure.

Combining Weight.—See Equivalent Weight.

Contrast.—Density range or gradation irrespective of productive conditions. Exposure, development (gamma) and subject contrast all contribute towards producing contrast, hence no individual factor is held solely responsible. See Gamma.

Crystalline.—A term applying to solid substances which assume a definite geometrical or crystal form. In chemistry such substances are usually salts which crystallise from solutions. They are usually transparent or translucent, and may or may not be combined with water molecules (water of crystallisation).

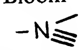
Decomposition.—Separation of molecules into simple elementary or compound components. The term covers a wide field in chemistry, including simple decomposition as when oxygen is freed from an oxide, double decomposition as in hydrolysis or when an exchange of radicles or ions takes place, *i.e.* $AgNO_3 + NaBr = NaNO_3 + AgBr$. Photo-decomposition (photolysis) occurs when silver bromide or other halides are exposed to light, *i.e.* $AgBr +$ photon $\rightarrow Ag + Br$.

Deliquescence.—Absorption of moisture from the air by water-soluble substances which finally liquefy.

Density.—The measured quantity of silver deposited (developed) in a negative per unit area. Density is the logarithm of opacity, $D = \log. O$ or $\log. I_0/I$, where I_0 is incident light intensity and I is transmitted fraction of intensity.

Desensitiser.—Substance which, when applied to an emulsion after exposure, nullifies the general optical or spectral sensitivity conferred by dyes, to the extent of permitting development by illumination of a colour and intensity which would be otherwise totally unsafe.

D.I.N.—A continental speed system somewhat similar to Scheiner but employing a step wedge instead of a sector wheel. The wedge transmits light intensities increasing by multiples of 1.27, under which the film or plate is exposed for 1/20 sec. to a 40-watt daylight-screened tungsten lamp. Development is such as to produce maximum emulsion speed, and the developed density giving a reading of 0.1 after deducting fog is assigned the number of the step (exposure) which produced it. The number is then multiplied by 10, but to distinguish it from Scheiner degrees, the value is expressed as a numerator over 10, thus: $2.5 \times 10 = 25$ or 25/10 D.I.N. See Scheiner; H and D; Speed Systems; Inertia.

Diazo Compounds.—Compounds possessing the characteristic grouping $-N{=}N-$ or $-N_2-$, obtained typically by the action of nitrous acid on the primary amines (diazotisation). In Bloomstrand's formula nitrogen is shown pentavalent thus:  analogous with the structure of ammonium salts and giving rise to the term diazonium in connection with salts of diazo compounds. Such compounds which may or may not be light-sensitive, react or couple mainly with phenols or naphthols to form azo compounds which constitute an important series of dyes. The basis of the diazo plan-copying process.

Efflorescence.—Loss of water of crystallisation causing the substance to assume dry or powder form.

Electrolytes.—Substances which ionise in solution and therefore are capable of being electrically decomposed. See Ionisation.

Equation.—Symbolic expression of a chemical reaction involving atoms, molecules or ions. Necessarily each side must be quantitatively equal thus: $HCl + NaOH = NaCl + H_2O$ (molecular form) or $H^+ + Cl^- + Na^+ + OH^- = Na^+ + Cl^- + H^+ + OH^-$ (ionic form). In place of = the sign $\rightarrow$ may be used. When a reaction is reversible maintaining equilibrium as in hydrolysis, the sign = is replaced by $\rightleftharpoons$. Evolution of a gas is indicated $\uparrow$, whilst precipitation is shown $\downarrow$.

Equivalent Weight.—The weight of a substance, element or compound, which will combine with one unit or part by weight of hydrogen or any other univalent element. 16 parts of divalent oxygen combine with 2 parts of univalent hydrogen to form water H_2O. Therefore 8 parts of oxygen are equivalent to 1 part of hydrogen. The equivalent weight of an element is thus the atomic weight divided by the valency. See Standard Solutions.

Esters.—Products of reaction between alcohols (alkyl hydroxides) and acids, sometimes called alkyl salts, being analogous to salts formed between inorganic acids and bases.

Ethers.—Contain two dehydrated alcohols (alkyl radicles) of the same or different type united to oxygen thus: $C_2H_5.O.C_2H_5$, or $CH_3.O.C_2H_5$.

Exposure.—The product of Light Intensity and Time (I × T), the former being a variable factor not only in respect of intensity, but also of colour. Reciprocal values of I × T are not necessarily equivalents of photo-chemical energy. (Reciprocity failure.)

Fog.—A layer of silver, uniform or otherwise, in addition to that of the image. The four main classes are: (1) Light fog caused by unintentional exposure of sensitive material to extraneous light. (2) Emulsion fog, occasionally inherent, but mostly caused or aggravated by long or faulty storage. (3) Development or chemical fog induced by over-energetic or unrestrained developers. (4) Dichroic fog consisting of a greenish yellow layer of colloidal silver deposited from an exhausted fixing bath, or during long immersion of a negative in a developer rich in sulphite or other halide solvent.

Gamma.—The slope of the characteristic curve as related to the log. exposure axis and expressed as the tangent of the angle so made. Gamma is equivalent to contrast in so far as density range increases with time of development. Gamma, however, is independent of the tonal range of the subject, which in itself may be of high or low contrast. It is, therefore, impossible to identify the factors producing contrast without a knowledge of the subject and conditions of development. See Contrast.

Grain.—Turbidity. The developed particles in a sensitive emulsion upon the size of which the resolving power depends.

Gram Equivalent.—The equivalent weight of any element or compound expressed in grams.

H. and D.—Initials of Hurter and Driffield used as a prefix to the numerical values obtained by their system. The originators regarded the lowest density occurring on the characteristic straight line as the true inertia and gave it the exposure value shown where a continuation of the said straight line cuts the log. E axis. The speed rating was calculated from the fraction 34/ inertia, 34 being an empirical value associated with the candle-metre.

Heterogeneous.—Appertaining to reactions when dissimilar phases are involved. Opposite to homogeneous. See Phase.

Homogeneous.—Appertaining to phases means all of the same kind. See Phase.

Hydrolysis.—A salt when dissolved in water tends to revert by double decomposition to the component ions of the acid and base which reacted to form it. If the reacting acid and base have not originally neutralised each other, as in the case of a strong base and a weak acid (or vice versa), the free OH ions now augmented by those from water will predominate over the feebly ionised H ions and the solution will be alkaline. Acids and alkalis containing an equal number of H^+ and OH^- ions respectively neutralise in the full sense of the term and in consequence do not undergo hydrolysis. Hydrolysis is the reverse of neutralisation, which see.

Hydroxonium Ion.—The hydrated hydrogen ion resulting from a combination of a hydrogen ion with a molecule of water, *i.e.* $H^+ + H_2O = H_3O^+$. In this way hydrogen has been shown to be very little different from many metallic ions which are also hydrated. On this assumption hydrochloric acid ionises thus: $HCl + H_2O \rightarrow H_3O^+ + Cl^-$.

Hydroxyl.—Univalent radicle OH, characteristic of alkalis and hydroxides. A component of water, *i.e.* $H^+ + OH^- = H_2O$, in which the ionisation or dissociation of the H^+ and OH^- ions is equal. See pH.

Hygroscopic.—Absorbing moisture from the air; not necessarily involving deliquescence.

Induction Period.—The time which elapses between immersion of the plate or paper in the developer and the first appearance of the image. Dependent on the natural development speed of the emulsion and the energy of the developer. The basis of Factorial Development.

Inertia.—The resistance of a sensitive emulsion to light-exposure. Actually, inertia is the exposure value required to produce the faintest developable density (threshold) and in this sense is the true indication of sensitivity. In the interests of accurate sensitometry, however, it is necessary to identify inertia with some density value capable of easy separation from fog and other confusion factors. The interpretation of inertia differs according to the system used. See Scheiner, D.I.N.; H. and D.; Speed Systems.

Interface.—The boundary between two phases.

Ions, Ionisation.—Atoms are electrically neutral, but if they combine by electro-valent linkage they give or receive electrons according to their valency and basic or acidulous character. Thus they are positively or negatively charged. Univalent sodium can give one electron to univalent bromine to form sodium bromide which is expressed ionically: $Na^+ + Br^- = NaBr$. In solution, acids, bases and salts which are bound together by such linkage are ionised and so are electrically conductive (electrolytes). Such linkage exists also between atoms and radicles, *i.e.* $Na^+ + Br^- = NaOH$ or $2H^+ + SO_4^- = H_2SO_4$. The plus and minus signs indicate the electronic charge carried by the ion and denote also the valency of the atom or compound radicle. See Hydrolysis; pH.

Ionisation Potential.—Energy in terms of equivalent volts required to displace an electron—in other words, to ionise it.

Isomerism.—The capacity of compounds to possess different properties whilst retaining the same formula. Thus $C_6H_4(OH)_2$ represents ortho-, meta- and para-dihydroxybenzene, although only hydroquinone (para-) and pyrocatechin (ortho-) can be used as a developer.

Ketones.—Compounds obtained by oxidation of a secondary alcohol, hence relation is similar to that of aldehydes to primary alcohols. Thus isopropyl alcohol $C_3H_7OH + O = CH_3.CO.CH_3$ dimethyl ketone or acetone. Bivalent keto (carbonyl) group $>C{=}O$ is characteristic of ketones and aldehydes, which see. Note comparison with aldehyde:

$$\begin{array}{c} R{-}C{-}H \\ \| \\ O \end{array} \text{ Aldehyde} \qquad\qquad \begin{array}{c} R{-}C{-}R \\ \| \\ O \end{array} \text{ Ketone}$$

where R represents an aliphatic or aromatic radicle.

Kinetics.—Appertaining to reactions, the relations between mass and motion which govern the movements of atoms, molecules and ions during separation and combination. A branch of dynamics.

Mass Action, Law of.—The fundamental law governing chemical reactions, enunciated by Guldberg and Waage, who stated that the amount of a chemical change taking place in a system is proportional to the active masses of the reactants. Since it is averred that equilibrium is dynamic, motion is implied. Rate of chemical change (velocity) is involved, which is the basis of reaction kinetics, the mathematical interpretation of which is found in text-books on Physical Chemistry.

Mole.—Gram molecule. The gram molecular equivalent or the molecular weight in grams. See Equivalent; Gram Equivalent.

Neutralisation.—Strictly when the combining reactants are incapable of further reaction. A misunderstood term since, according to their basicity, polybasic acids may be partly or completely neutralised in steps. Furthermore, neutralising equivalents of an acid and base may produce an acid or alkaline solution, in which case the participants are neutralised but the salt is not neutral. Efforts to neutralise the salt will disturb the stoichiometrical relation between acid and base, with the establishment of a new equilibrium providing in effect a buffer solution. See Buffering; Hydrolysis.

Opacity.—Light stopping power. The ratio between a unit of light entering a substance and the fraction emerging, and is therefore equal to I_0/I, where I_0 = incident light intensity and I = transmitted fraction.

Oxidation.—Addition of oxygen or removal of hydrogen. Reverse of reduction, and one cannot take place without the other. In organic development the oxidation of hydroquinone is:
$C_6H_4(OH)_2 - 2H^+ (-2e) \rightarrow C_6H_4O_2$ (quinone), in which case

hydroquinone is deprived of hydrogen or de-electrolised. The addition of oxygen is typified by $Na_2SO_3 + O = Na_2SO_4$.

Phase.—A component of a system. A term for the physical state of a component which may be a liquid, solid or gas. Dissimilar phases form heterogeneous systems which have physical boundaries at which interface reaction is confined. Phases which are similar and form no such defined physical boundaries react homogeneously. Phase reactions may be complicated with the formation and disappearance of phases. All such changes or otherwise take place in a system which is a prescribed enclosure containing the components.

Polymerism.—The uniting of molecules with those of their own kind and structure to form multiple compounds of greater molecular weight. Formaldehyde CH_2O polymerises to form trioxymethylene $(CH_2O)_3$ as a triple molecule.

pH.—Symbol indicating hydrogen ion concentration. Defined as the logarithm of the reciprocal of the hydrogen ion concentration, or its negative logarithm. In neutral water, the product of the H^+ and OH^- is 10^{44} grams per litre. Since the ions dissociate equally, the value of either $[H^+]$ or $[OH^-] \doteq \sqrt{10^{-14}} = 10^{-7}$. $\text{Log}_{10} [H^+] = -7$, but $-\log [H^+] = 7$, which is the reciprocal, hence the positive index is taken as the value of pH. 7 is the neutral value, so that a numerical decrease, say, to 3 implies an increase in the concentration of hydrogen ions, remembering, of course, that the actual concentration is 10^{-3}. Similarly, an increase numerically above 7 denotes an increase in alkalinity for the same reason. The ionic product of water 10^{-14} is constant at 22° C., hence for any solution acid or alkali at this temperature the product $[H^+] \times [OH^-]$ must always equal 1×10^{-14}.

Preservative.—Usually a sulphite or acid sulphite capable, during storage of a developing solution, of selective oxidation, thus preserving the developing agent from oxidation. During development the preservative prevents the formation of coloured quinonoid oxidation products, thus keeping the developer relatively colourless until the preservative is itself oxidised.

Quaternary.—Signifying four or in fours. In its simplest chemical sense a quaternary compound comprises four atoms, *e.g.* NH_3. On the other hand, a quaternary carbon atom has all four *valencies* linked to carbon, whilst in the radicle ammonium NH_4, hydrogen is quaternary in respect of nitrogen. In quaternary salts of heterocyclic nitrogen compounds, pentavalent nitrogen has three valencies linked to two cyclic carbon atoms, the two remaining valencies being attached individually to the radicles of a salt usually a hydrocarbon and an acid radicle such as are contained in an alkyl halide, *i.e.* methyl iodide CH_3I. See Amines.

Radicles or Radicals.—Usually compound groups, many of which are hypothetical and incapable of separate existence, although they have valency as in the case of atoms. Examples are OH, SO_4, CH_3, NH_2, etc.

Reduction.—Addition of hydrogen or removal of oxygen. See Oxidation.

Reduction Potential.—The inherent and latent reducing energy of a developing agent. Modern methods of estimation are too complicated for brief description, but Sheppard and Neitz found that an approximate measure of reduction potential was indicated by the comparative resistance of the various developing agents to the restraining influence of bromide. To hydroquinone was assigned the arbitrary value of 1, in relation to which other developers have a higher or lower value.

Restrainer.—A halide salt such as potassium bromide possessing an anion in common with the sensitive silver halide or halides. The depression so caused prevents the free release of hydrobromic acid as a product of development and its subsequent neutralisation by the combined influence of the reducing agent and the alkali.

Saturation.—Maximum absorption. In respect of a solution containing a substance to maximum solubility. Appertaining to chemical compounds, those in which all valancies are occupied and can only change by substitution.

Scheiner.—An emulsion speed system established by Drs. Scheiner and Eder. Using standard light source and a sector wheel, a plate or film is given a series of exposures, each of which is 1.27 times greater than the previous one. After development, the graded negative is placed in contact with white paper and the sector slot number indicating that producing the weakest density is taken as the speed value. This method indicates the true threshold which in the H and D system is purposely avoided. Since 1.27 is approximately the cube root of 2, an increase of 3 degrees is equivalent to doubling the speed.

Speed Systems.—Various methods by which emulsion sensitivity is rated by measuring inertia as identified with some arbitrarily selected density and the exposure value responsible. Individual systems differ in their interpretation of inertia and other contributory factors, hence the impossibility of equating the ratings of the systems now in vogue. The importance now attached to the so-called under-exposure region of the characteristic curve compels preference to be given to those systems which express speed in terms of true threshold sensitivity. See Scheiner, D.I.N., H and D; Inertia.

Standard Solutions.—Solutions containing reagents of selected and definite activity for use in volumetric analysis. 1 litre of solution containing the equivalent weight of a substance in grams is termed a normal solution. Solutions containing half, one-tenth or one-hundredth of the gram equivalent are termed semi-, deci-, and centi-normal solutions respectively. An acid normal solution will contain 1 gram equivalent of ionisable hydrogen per litre. Thus the gram equivalent weight of sulphuric acid H_2SO_4 containing 2 atoms of hydrogen per molecule will be half its molecular weight. In a similar way the equivalent weight of a hydroxide is found by dividing the molecular weight by the number of hydroxyl radicles. See Equivalent Weights; Titration.

Stoichiometry.—The quantitative determination of the proportions in which elements combine as governed by the Laws of Constant, Multiple and Reciprocal Proportions. Necessarily involves valency.

Subbing Layer.—Also " sub " or " subbed layer. " One or more layers, or sub-strata, of gelatine or other substance coated on to a support prior to applying a sensitive emulsion which is then more firmly attached and less liable to strip or frill. The process is known as "subbing".

Surface Tension.—The force existing at the boundary or interface formed between phases. A high surface tension prevents the even and rapid flow of a liquid over the surface of a solid. This resistance to flowing may be decreased by adding a wetting agent which lowers surface tension. See Interface; Phase.

Temperature Coefficient.—As applied to development, the change of velocity (rate of development) due to temperature change. This is taken as the difference between the velocity at one temperature and that at 10°C. higher or lower, or approximately equal to 18°F.

Threshold.—(1) Threshold densities. Those which lie at the very beginning of the toe of the characteristic curve representing the true inertia. (2) Threshold exposure. The exposure value required to overcome inertia and cause the faintest developable density. (3) Threshold development energy. The capacity of the developer to give maximum development (density) to threshold exposures.

Titration.—The method of using a standard solution and an indicator so that its volume may be accurately measured immediately it reacts with another solution. The principle of volumetric analysis. See Standard Solutions.

Transparency.—Reciprocal of opacity. If opacity $= I_0/I$, then Transparency $= I/I_0$. See Density; Opacity.

Triturate.—Grinding or otherwise reducing a substance to a fine powder.

Valency.—The number of hydrogen atoms or those of another univalent element required to combine with one atom of another element or compound radicle. Thus elements and radicles which are univalent, divalent and trivalent combine with one, two and three atoms of hydrogen respectively. Valency equals the atomic weight divided by the equivalence. See Equivalent Weight.

Velocity.—The rate at which a chemical reaction (or development) proceeds. It is governed by concentration and temperature.

Velocity Coefficient or Constant.—Symbolised by k in equations. It represents the initial effort, or the fraction of a substance which would change in unit time if the concentration could be maintained at unity. Concentration, however, must instantly begin to diminish, hence the shorter the time unit chosen, the smaller will be the change in concentration. It is usual to apply the infinitesimal calculus, and for a first order of unimolecular reaction the first derivative or differential equation is $dx/dt = k\ (a - x)$, where a is the initial concentration reduced by the quantity x in the time t. k is the velocity constant. In development it is the amount of silver reduced to metal in unit time thus: $dD/dt = k\ (D_\infty - D)$.

Velocity Curve.—In development, an exponential curve representing gamma or density as a function of development time. Known also as the gamme-time and density-time curve. It may be calculated or plotted from periodic observations.

DESENSITISING

Desensitisers are supplied, some as stock solutions, some as powders or tablets which are dissolved to form a stock solution. This keeps well if stored in a brown bottle. Any of them can be used as a fore-bath, and except where otherwise stated can instead be added to the developer. **Desensitisers must not be used with certain fine grain, particularly super fine grain, developers. They must not be used with Dufaycolor films, nor with certain brands of panchromatic and super speed ortho materials, some of which refuse to develop after desensitising.** Any new material should therefore be submitted to a preliminary test.

Desensitising Green (Pinacryptol Green). (Cloak & Dowdeswell.) (1-gm. tubes.) Stock solution 1 : 500. Dilute 1 : 20 for use. Some increase in developing time may be necessary. With developers containing hydroquinone, should be used only as a forebath, but may be added to plain metol, amidol, glycin, and Ilford Certinal developers.

Ilford Desensitising Tablets. (Ilford Limited.) Supplied as Ilford D.S. Green tablets and Ilford D.S. Yellow tablets. Both types are packed individually in Cellophane (like aspirins) in holders containing 10 tablets. Both desensitisers are normally recommended for use as preliminary baths: one tablet of either type makes $3\frac{1}{2}$ ozs. of working strength desensitising solution. D.S. Green desensitiser can be added to the developer in certain circumstances. It can be added to Cine developers to prevent aerial fog.

Johnsons Yellow Desensitiser. (Johnsons of Hendon Ltd.) A non-staining desensitiser in powder form. Dissolve contents of tube in 20 ozs. of hot water. Use undiluted when cold, as forebath only.

Pinacryptol Green. (Cloak & Dowdeswell.) (1-gm. tubes.) Stock solution 1 : 500. Dilute 1 : 20 for use. Can be used as forebath or added to certain developers. Wetting agent may be added.

Pinacryptol Yellow. (Cloak & Dowdeswell.) (1-gm. tubes to make 2,000 c.c.s. of working solution.) Used as forebath only. Particularly recommended for use with panchromatic materials and colour film, *but see note above*. Wetting agent may be added.

P.A.C. Desensit N. (P.A.C. (Photographics) Co. Ltd.) Does not stain, fog, or affect the latent image. For use as a forebath, dilute the stock solution as supplied with four or more volumes of water and bathe the film 30—60 seconds. Can also be added to the developer.

For a fast pan emulsion add 20 c.c.s. per litre. Green safelight may be turned up after 30 seconds.

P.A.C. Desensit P. For developing **papers** in a bright light. Add 5 c.c.s. to a litre of developer. After 30 secs. immersion a bright orange light is safe for bromide paper, bright yellow for chloro-bromide, or ordinary room light for contact (gaslight) paper. An acid fixing bath removes any slight yellow stain.

HYPERSENSITISING, LATENSIFICATION

It is possible, within certain limitations, to increase the effective speed of a sensitive material by treatment either before exposure, or between exposure and development. Fantastic claims have been made for phenomenal speeds so obtained, but it can be taken that the maximum possible increase for all ordinary purposes is little more than one stop—twice the normal speed or a little over, and this only under certain conditions. For a full discussion of the subject the reader is referred to the paper by G. S. Moore, " The Last Ounce of Speed ", *Phot. J.*, **88A**, 239-243, Nov. 1948.

Hypersensitising, or treatment before exposure, can be achieved in three ways: pre-bathing in ammonia; subjecting to mercury vapour; and pre-exposure to a controlled intensity of light for a time just not sufficient to cause fogging.

The Ammonia method is applicable to certain panchromatic plates, and is the only one of use for anything but astronomical or other work calling for long exposures. Moreover it increases only the colour sensitivity, not the general sensitivity to blue light. For this the material is bathed for 4 minutes in:

Alcohol 90 per cent. or pure methyl alcohol ...	25 c.c.s.
Concentrated ammonia	3 c.c.s.
Water to	100 c.c.s.

and dried rapidly at room temperature. The material must be used without delay. Similar hypersensitisation results from washing for 5 minutes in running water or several changes instead of bathing in ammonia. The water must be free from chlorine.

Exposure to mercury vapour sometimes achieves some 2-3 times increase, but it is unreliable, liable to lead to fog, and is most effective for long-exposure work.

Pre-exposure to light for about 1/25th second for a time just sufficient to show a perceptible increase in fog results in an increase in speed for long-exposure work. It is of no use for ordinary short exposures.

Latensification is an intensification of the latent image after exposure, the effect of which is to increase the effective speed of the emulsion. It may be achieved by bathing in various reagents; by exposure to certain vapours; or by exposure to light of controlled intensity.

Exposure to light is the simplest and most reliable method and provided it is systematically carried out will safely increase the speed of many materials without excessive contrast or graininess. In contradistinction to pre-exposure, hypersensitising it is most effective for short exposures of 1/25th second or less. The colour of the fogging light is immaterial, and the most convenient source is a safelight of such intensity and size that at about 6 ft. an exposure of ½ to 1 hour gives about double the normal fog level. The speed increase is greatest when development is not carried to a high gamma.

Exposure to vapour of mercury at normal temperature for a period of some 24 hours is often effective for ordinary short-exposure work, but the results are not reliable or predictable.

Sulphur dioxide vapour, produced by mixing equal quantities of 10 per cent. solutions of anhydrous sodium sulphite and of acetic acid, for 24 hours in a closed container, with free access of the vapour to the film, gives useful latensification with some materials, but with others it leads to excessive fog, unreliable results, and little speed increase.

Bathing in a solution of 3.4 per cent. sodium sulphite and 0.5 per cent. potassium metalsulphite with subsequent development with vigorous agitation in ID-2 developer for 3½ minutes at 68°F. gave two-fold latensification with Ilford HP-3 film at a low gamma, but over gamma 0.8 the speed increase diminishes.

NEGATIVE DEVELOPERS

Note on Developer Poisoning

Developer poisoning usually manifests itself by a local reaction on the fingers, commencing as "itching" which may go on to a dermatitis. This may be due to two causes, allergic where there is a sensitivity to any of the chemicals used or to the high alkalinity of developers. Metol is an example of the first type of reaction, and as the normal pH of the skin is roughly from 4 to 6, the constant use of solutions pH8.5 to 11 is likely to influence the causation of a dermatitis. Prevention may be achieved by wearing gloves (this is not to be recommended for use over long periods, as there is danger of maceration of the epithelium). The ideal protective is a barrier cream. In most cases the Innoxa barrier cream for wet work, obtainable at all chemists, gives adequate protection, but readers who continue to experience trouble are advised to write to Innoxa (England) Ltd., 233 Balls Pond Road, London, N.1, for their booklet. In such cases Innoxa are prepared to supply a free sample of a suitable cream for trial.

The hands should be washed thoroughly with toilet soap and hot water after using any photographic solution.

Should itching or superficial dermatitis develop the following cream is useful:

Calamine	grains 50
Zinc oxide	,, 20
Liquid paraffin	minims 5
Lanette Wax SX emulsion ...	oz. 1

This forms an easily applied emulsion and if the itching is not controlled 2 per cent. Phenol or Menthol may be added.

The standard preparation of Calamine Lotion is often of use alone or if the skin is broken Lin. Calaminæ Co. B.P.C. can be applied. Should sepsis develop a skin physician must be consulted.

The Choice and Qualities of Developers

It is often argued with considerable truth that the number of developer formulæ published in the Almanac and other standard works of reference is far in excess of that required by the average photographer. It is, indeed, quite possible and successfully practical regardless of subject to carry out the development of all types of plates and films, and further to make the necessary prints on any type of modern developing paper, using a single well-balanced M-Q developer of the Ilford ID-36 or Kodak D-158 type. With such a formula, the only adjustment necessary is the amount of water added to the stock solution and the discriminate addition of potassium bromide in certain cases.

How then do we justify the array of formulæ, relatively small though it is, which appear in the following pages ? First must be considered the newcomer to photography, who regardless of sound advice will be tempted to experiment with almost every formula which comes his way. Secondly, there is the expert who desires to find always his favourite formula in the current Almanac, and at the same time be apprised, particularly in the case of fine grain developers, of any change that has taken place in developing technique. It should, however, be understood that each Almanac formula is typical of a distinct type, and the whole selection is representative of the best of such types in common use to-day. The only duplication is in the manufacturers' formulæ included, all of which are highly recommended M-Q developers likely to be used for special purposes.

However carefully the process of development is carried out, the presence of so many variable factors introduces a fortuitous element which tends to defeat any but the most determined and systematic effort to obtain absolute accuracy. For example, errors in timing; incorrect recording of temperature, or its fluctuation during development; an inaccurately compounded developer, or its exhaustion or age; the use of stale or poor quality chemicals: all are influential factors in the course of development. Add to these influences exposure faults, and the rare but possible slight variation of speed and development rate of any make of film and plate from batch to batch, and we are faced with a formidable list of variables any one of which can seriously affect consistency in negative production. Furthermore, each distinct type of film and plate has its own developing speed. Similarly, each developer possesses its own velocity or rate of development; hence the problem is to arrive at the correct development time for individual types of sensitive material under widely different conditions. Taking the sum total of available British films and plates, it will be found that no fewer than 16 time groups are necessary for the correct development of each type. Since, however, the consecutive time variation in such a large number of groups is in some instances but a fraction of a minute, it is possible to reduce the group numbers considerably. Certain calculators and the manufacturers of proprietary developers limit such groups to from five to eight, although the value of the development times so derived is often considerably reduced by lack of reference to any specific degree of negative contrast or gamma. Actually, the most reliable method of obtaining accurate development time is by reference to the makers' development time-gamma curves, but since these only apply to certain formulæ, a series of groups associated with some particular gamma value should be available. Now it is well known that all plates and films develop to a maximum degree, as regards tonal scale and density, known as gamma infinity. As a *practical* degree of development this means a time in which development is the maximum consistent with a minimum of fog. By adopting practical gamma infinity as a development standard, therefore, we can be assured that a first test with a new type of film and a different developer will not be under-developed; it will be an easy matter on future occasions to relate exposure with a shorter development time until a negative of the required gradation or gamma is obtained.

In regard to the Almanac formulae developing times, it was decided after careful consideration to limit the film and plate groups to four, which our experience has shown us to be sufficient guide to the first use of a new formula or film. Alongside these group items will be found developing times for certain well-known fine grain formulæ, including the various group numbers for Johnson's and Burroughs Wellcome fine grain and other developers. Development times for "Promicrol" and Ergol, and for 'Capitol' for attaining maximum emulsion speed, are given in separate tables. The list of sensitive materials is not complete, but is representative of plates and films used most frequently by professionals and amateurs, being also those with which we have had intimate experience.

Some anomalies will be found when comparing developing times as given by manufacturers of various developers and sensitive materials. Less confusion would arise if in all cases such developing times were given in association with some definite value of gamma. In the case of Ilford and Kodak films and plates valuable information can be obtained from the gamma-development time curves obtainable from these firms. Since these times are only for a limited number of recommended developers, this information is of little use as applied to other or proprietary developers. However, a careful study of the groups and times given should furnish sufficient information to guide the worker in early stages of experience with a new formula and previously untried plate or film. Remember that in early stages of development, and particularly in short time dish development, timing must be more accurate than when developing to maximum gamma.

An important operation about which there is no general agreement is the degree of agitation to be given during development. The times given for Almanac tank developers are based on thorough agitation for one minute initially and twice later at evenly spaced intervals during the remaining time. For dish development slow, but continuous rocking is recommended. If intermittent agitation at, say, one minute intervals is given, the times for Almanac formulæ may be reduced by 15-20 per cent.

Always remember that subject contrast exposure value, and development are co-partners in the production of the perfect negative, and since threshold or shadow densities are important in relation to negative contrast, slightly more exposure may be necessary when developing to gamma values lower than usual. Some developers, such as Kodak D-76, maintain the full emulsion speed of the film and give good threshold expression at an early stage of development, whilst others with poor threshold developing power give a virtual emulsion speed reduction.

In this short introduction, we have endeavoured to point out the difficulties of maintaining the correct relation between all the variable factors which must be considered step by step from initial exposure to the finished negative. The same introduction should, therefore, serve to emphasise the futility of hoping to arrive at any correct developing times without first gaining considerable experience of the character and behaviour of the sensitive materials and developers selected.

FILM AND PLATE GROUPS AND DEVELOPING TIMES

The Almanac groups given below are for formulæ given in the following pages. Johnson's group numbers refer to all that Company's products in addition to those manufactured by Burroughs Wellcome under the name ' Tabloid ' brand. The times give for " Promicrol " on page 270 have been supplied by May & Baker as the result of their tests on a number of sensitive materials, whilst the times given for "Microdol", D-76, D-23, D-25, D-61a, and DK-20 are for Kodak sensitive materials only. ID-11 is identical with D-76 and the developing times for a number of Ilford and Kodak Plates and films are given under this combined heading.

From the various times given for different developers it should not be difficult to estimate fairly accurately the development times required for films and plates against which individually there is no time given.

All development times are for 68° F.

P= Plate. SF=Sheet Film. RF=Roll Film. M=35 m/m Miniature Film.

Almanac Groups The Group Numbers below apply only to the standard formulae given on pages 290-295 for which the standard (Group 4) developing times are tabulated beside the formulae.	Johnson's Group Nos.	Kodak Microdol & DK-20	ID-11 & D-76	D-23	D-25	D 61a (1+3)
		min	min	min	min	min
Group 1 Reduce developing times given by three quarters						
Criterion Ordinary P	1	—	—	—	—	—
Ilford N8.30 Fine Grain Ordinary Series 2 SF ...	1	—	3¾	—	—	—
,, N.30 Ordinary P	1	—	3¾	—	—	—
,, G.30 Chromatic P	2	—	4¼	—	—	—
Kodak B-40 Fine Grain Regular P	—	—	3	—	—	2
Group 2 Reduce developing times given by one half						
Ferrania Super Panchro P3 M	2	—	—	—	—	—
Ilford Special Rapid P	2	—	6	—	—	—
,, R.20 Spe ial Rapid Pan P	2	—	6	—	—	—
,, Selochrome P	3	—	6½	—	—	—
,, Orthotone P	4	—	8½	—	—	—
,, Pan F. M	2	—	6½	—	—	—
Kodak O 250 Rapid Ortho Metallographic P ...	—	7	5	—	—	3¾
,, P 300 Special Rapid Pan P	4	6	5	—	—	2½
,, P 1500 Lightning Pan P	3	7	5½	—	—	3¾

Almanac Groups

The Group Numbers below apply only to the standard formulae given on pages 271-276 for which the standard (Group 4) developing times are tabulated beside the formulae.

	Johnson's Group Nos.	Kodak Microdol & DK-20	ID-11 & D-76	D-23	D-25	D-61a (1+3)
		min	min	min	min	min
Group 3 — Reduce developing times given by one quarter						
Bauchet Hyperchromatique RF	5	—	—	—	—	—
„ Hyperpan RF	5	—	—	—	—	—
Crumiere Super Aviachrome RF	4	—	—	—	—	—
„ Aviapan RF	4	—	—	—	—	—
Dufay Ortho RF	4	—	—	—	—	—
„ Pan RF	4	—	—	—	—	—
„ Super 50 Pan RF	5	—	—	13	—	—
Ferrania Ultrachromatica RF	4	—	—	—	—	—
„ Super Panchro RF	5	—	—	—	—	—
„ „ „ S2 M	5	—	—	—	—	—
Gevaert Superchrome SF & RF	5	—	—	—	—	—
„ „ P	6	—	—	—	—	—
„ „ 30 P, SF & RF	5	—	—	—	—	—
„ „ 27 SF, RF & M	3	—	—	—	—	—
„ Gevapan 33 RF	6	—	—	—	—	—
„ Microgran Panchro P	4	—	—	—	—	—
„ „ „ RF	3	—	—	—	—	—
„ „ „ M	3	—	—	—	—	—
„ Panchromosa P, SF, RF & M	5	—	—	—	—	—
„ Superchromosa P	4	—	—	—	—	—
„ Gevachrome P, SF & R.F	5	—	—	—	—	—
Ilford Soft Gradation Pan P	6	—	10	—	—	—
„ R.10 HP3 P	5	—	9	—	—	—
„ HP3 M	6	—	10	—	—	—
„ „ SF	6	—	9	—	—	—
„ FP3 RF	4	—	8½	—	—	—
„ „ M	4	—	8½	—	—	—
„ „ SF	4	—	10	—	—	—
„ Selochrome SF	4	—	7½	—	—	—
„ „ RF	5	—	9	—	—	—
Kodak Commercial Fine Grain SF	—	7½	5½	—	—	3
„ Commercial Ortho SF	5	13	10	—	—	7½
„ O 800 Speed Super Ortho P	5	11	13	—	—	7
„ P 1200 Super Pan Press P	5	11	11	—	—	6
„ Super Panchro Press SF	6	10	9	—	—	5½
„ Plus X RF	5	10	9	—	—	7
„ „ „ M	5	12	11	16	18	—
„ Panatomatic X SF	3	15	13	—	—	6½
„ „ „ RF	4	16	11	16	18	8
„ „ „ M	4	17	11	13	14	—
„ Verichrome RF	5	10	9	16	18	7
„ Super XX RF	5	14	12	16	18	12
Lumiere Super Lumichrome RF	5	—	—	—	—	—
„ Lumipan RF & M	6	—	—	—	—	—
Group 4 — Developing times as given						
Crumiere Aviapan RF	7	—	—	—	—	—
Gevaert Gevapan 33° P, SF & M ...	6	—	—	—	—	—
Ilford Zenith P	6	—	12	—	—	—
„ Hyperchromatic SF	6	—	14	—	—	—
„ G8.30 Commercial Ortho SF ...	2	—	12	—	—	—
„ HP3 RF	6	—	10	—	—	—
„ HPS P	—	—	14	—	—	—
„ HPS SF	—	—	14	—	—	—
Kodak Ortho X SF	6	13	14	—	—	11
„ Super XX M & Bantam	7	14	11	22	24	—
„ Super XX SF	5	13	13	—	—	8

DEVELOPMENT TIMES FOR "PROMICROL"

Emulsion	Type	Development time in minutes for gamma stated		
		0.6	0.7	0.8
Adox				
Pan 32°	RF	9	11	13
Pan 30°	RF	9	11	13
Pan 28°	M	5½	7½	10
Pan 32°	M	7	9	11½
Pan 24°	M	5	7	9
Agfa				
Isopan F	RF	16	22	26
Isopan F	M	4½	6	7
Isopan ISS	RF	16	24	28
Isopan ISS	M	6½	7½	9
Isopan FF	M	6	7½	9½
Ansco				
Super Press	RF	15	20	26
Barnet				
Super Speed Ortho	SF	12	16	21
Ultrapan	SF	11	20	—
Ultrasensitive Pan...	P	9	11	14
Soft Pan	P	14	19	—
Special Rapid Pan...	P	4½	7	10
XL Super Speed Pan	P	8½	10	12
Bauchet				
Hyperpan Special Rapid	RF	7	9	11½
Crumière				
Aviapan	RF	10½	12½	14½
Dalco				
Spectropan	RF	13	17	22
Mezzopan	RF	12½	15½	19
Mezzochrome	RF	13	16	22
Dufay				
Ortho	RF	8	10	12
Pan	RF	11½	17	—
Ferrania				
Ultrachromatica	RF	6½	8½	10½
Superpanchro S.2	M	5½	6½	7½
Superpanchro P.3	M	5	5½	6
Superpanchro 32	RF	7	8½	10
Superpanchro 28°	RF	12	14	16½
Super Rapide 32°	P	7½	9	11
Gevaert				
Gevapan 33	RF	6	8½	10½
Gevapan 33	SF	15	17	20
Gevapan 33	M	8	10	12½
Microgran	RF	6½	8	10
Microgran	M	5	6½	8
Superchrome	RF	9	11	14½
Superchrome	SF	11	13	16
Superchrome	P	7	8½	10
Panchromosa	RF	5	6½	7½
Panchromosa	M	7½	9	10½
Panchromosa	P	6	7½	9½
Granville				
Finachrome	RF	6½	8½	10
Hauff				
Pancola	RF	7	9	11
Pancola	M	8	10	12
Pancola Super	RF	10	12	14
Pancola Super	M	10	12	14
Pancola Granex	M	8	10	12
Ulcroma	RF	8½	11	13

Emulsion	Type	Development time in minutes for gamma stated		
		0.6	0.7	0.8
Ilford				
Hyperchromatic	SF	14	18	22
H.P. 3	SF	12	16	20
H.P. 3	RF	8½	10	13
H.P. 3	M	8	9½	11½
H.P. 3	P	8½	10	12
F.P. 3	RF	8½	11	14
F.P. 3	M	7½	10	13
Selochrome	SF	11	14	18
Selochrome	RF	7½	10	13
Pan F	M	5	7	9
H.P.S.	P	9½	12	15
Press Ortho Series 2	P	11	14	18
Selochrome	P	10	12	15
Soft Gradation Pan	P	11	13	16
Special Rapid Pan...	P	6	8	11
Special Rapid	P	5	7	10
Zenith	P	5	7	10
Kodak (U.S.A.)				
Super XX	RF	10	13	15
Super XX	M	7½	9	12
Plus X	M	9	11	14
Verichrome	RF	8½	11	14
Kodak (Canada)				
Super XX	RF	10	11½	14
Plus X	RF	12	14	17
Verichrome	RF	10	12½	15
Super XX	M	14	16	19
Plus X	M	9	10½	13
Super XX	SF	10	12	15
Super Panchro Press	SF	14	17	20
Tri X	SF	13	15	18
Kodak (France)				
Super XX	RF	16	27	—
Verichrome	RF	10	12	14
Panatomic X	RF	10½	13	15
Panatomic X	M	7½	11	13
Super XX	M	6½	8	11
Kodak (Great Britain)				
Super XX	SF	10	13	20
Super XX	RF	11	18	—
Super XX	M	7	9	12
Panatomic X	SF	10	13	20
Panatomic X	RF	7	8	10
Panatomic X	M	7	10	15
Commercial Ortho	SF	7	10	12
Ortho X	SF	9½	11	14
P. 1500	P	7	9	11
P. 1200	P	9	12	19
Plus X	RF	7	10	14
Plus X	M	7	9	12
Verichrome	RF	9	11	14
Lumière				
Altipan	RF	12½	16	23
Lumipan	RF	16	23	27
Mimosa				
Panchroma	RF	11	13	16
Perutz				
Perpantic	RF	5½	7½	10
Peromnia	RF	4½	6½	8½
Perpantic	M	5½	7½	10
Peromnia	M	5½	7½	10
Pergrano	M	3	5½	7½

One- and Two-Solution Developers

The following metol and metol-hydroquinone formulæ are given in one-solution form, but the two-solution form is preferable on account of its better keeping properties. In both formulæ instructions are given for so dividing them, in which case it should be noted that the A solution containing the developing agent will be still better preserved if a small quantity of acid is included. Either citric acid or potassium metabisulphite is suitable, 5 to 10 grains per 20 ounces of solution being sufficient. If this course is adopted the B solution should contain an added quantity of alkali to neutralise the acid. Five grains of citric acid is neutralised by approximately 10 grains of sodium carbonate crystals, whilst 5 grains of metabisulphite requires 12½ grains of the same alkali.

Metol *

Metol ..	75 grs. (17 gms.)
Sodium sulphite, cryst.	1¼ ozs. (125 gms.)
Sodium carbonate, cryst.	1¾ ozs. (175 gms.)
Potassium bromide	8 grs. (1.8 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

Development Times—Minutes

65°	70°	Dilution
7	6	1 Developer to 2 Water
18	15	1 Developer to 5 Water
38	30	1 Developer to 10 Water

A clean-working developer giving soft gradation and full shadow detail. Excellent for portraits and subjects of strong contrast.

Two-Solution Metol

A clean-working developer giving soft gradation and full shadow detail. Excellent for portraits and subjects of strong contrast.

The single solution keeps in good condition for several weeks but for intermittent use it is best made up as follows: In the volume of water prescribed for the single solution—10 ounces (1,000 c.c.s.)—dissolve the metol, sulphite and bromide, plus acid is used, and label this " Solution A." Into an equal volume of water dissolve the carbonate and label this " Solution B." One part of A combined with 1 part of B will then be equal to 1 part of the single solution plus 1 part of water.

Under-exposure may be successfully dealt with by increasing the quantity of B. For over-exposure decrease the ratio of B with added bromide, and in severe cases develop in Solution A only.

B. J. Universal M-Q Formula

Metol	7 grams.	¼ oz.	(3.15 gms.)
Hydroquinone	28 grams.	1 oz.	(12.6 gms.)
Sodium sulphite anhyd.	125 grams.	4½ ozs.	(56 gms.)
Sodium carbonate anhyd.	140 grams.	5 ozs.	(63 gms.)
Potassium bromide ...	4.5 grams.	70 grains	(2 gms.)
Water	2,225 c.c.s.	80 ozs.	(1,000 c.c.s.)

* For note on preparing metol solutions see page 277.

A well-balanced formula of normal contrast suitable at appropriate dilutions for plates and films of all types, also for bromide, chloro-bromide, photomechanical, and document papers.

For bromide and chloro-bromide papers dilute with 2 or 3 parts of water and develop for 2 minutes at 65° F.

For photomechanical and document papers use at full strength or diluted with an equal part of water. Average development times 1½-2 minutes at 65° F.

For line and process films use at full strength or diluted with an equal quantity of water. Average development times 2 to 4 minutes at 65° F.

For normal negative development dilution to give dish, medium or long time tank times may be as here given:

65°	70°	Dilution
8 mins.	6½ mins.	1 : 2 DISH
13 mins.	10 mins.	1 : 5 TANK
22 mins.	17½ mins.	1 : 10 TANK

Two-Solution Metol-Hydroquinone

The above developer keeps in good condition for several weeks, but for intermittent use it is best made up as follows:—In the volume prescribed for the single solution—10 ounces (1,000 c.c.s.)—dissolve the metol, sulphite, hydroquinone and bromide, plus acid if used, and label this "Solution A." Into an equal volume of water dissolve the carbonate and label this "Solution B." One part of A combined with 1 part of B will then be equal to 1 part of the single solution plus 1 part of water.

Hydroquinone-Caustic Process Developer

A.	Sodium bisulphite... ...	110 grs.	(25 gms.)
	Hydroquinone	110 grs.	(25 gms.)
	Potassium bromide ...	110 grs.	(25 gms.)
	Water, to make	10 ozs.	(1,000 c.c.s.)
B.	Caustic soda	200 grs.	(45 gms.)
	Water, to make	10 ozs.	(1,000 c.c.s.)

For use mix equal parts of A and B and develop for 2 minutes at 65° F. Rinse well before acid-fixing to avoid stain.

Single-Solution Hydroquinone-Caustic

Kodak D-8 Formula.

Sodium sulphite cryst.	787 grs.	(180 gms.)
Hydroquinone	197 grs.	(45 gms.)
Caustic soda	164 grs.	(37.5 gms.)
Potassium bromide	131 grs.	(30 gms.)
Water	10 ozs.	(1,000 c.c.s.)

For use take 2 parts stock solution to 1 part water. Develop for 2 minutes at 68°F. This developer keeps for several weeks bottled, and retains its energy for several hours in the open dish. Without loss of density, the caustic soda may be reduced to 28 grams (122 grs.) in which case the stock solution will keep still longer.

With caustic soda in above reduced to 18 gms., this formula becomes D-178, suitable for graticules, using Kodak Maximum Resolution plate. At same dilution, develop 3-4 minutes at 68° F.

Maximum Energy Developer

(Kodak D-82)

Recommended for under-exposures.

Water (about 125°F.)	7½ ozs.	(750 c.c.s.)
Wood alcohol	½ oz.	(48 c.c.s.)
Metol	60 grs.	(14 gms.)
Sodium sulphite (anhydrous) ...	230 grs.	(52.5 gms.)
or crystallised	460 grs.	(105 gms.)
Hydroquinone	60 grs.	(14 gms.)
Caustic soda	38 grs.	(8.8 gms.)
Potassium bromide	38 grs.	(8.8 gms.)
Cold water, to make	10 ozs.	(1,000 c.c.s.)

Develop from 4 to 5 minutes at 68° F. (20° C.).

In cases where this developer is found to produce excessive contrast or give rise to fog, a pyro surface developer or a highly accelerated metol developer will probably give satisfactory results.

Amidol

Amidol gives negatives of soft to normal contrast with good shadow rendering. Its keeping properties depend largely on the age and condition of the dry substance. It is best to regard its maximum life in solution as about three days, although weakly alkaline amidol may only last a few hours. It is said that certain acids will preserve amidol, but there seems little advantage in preserving a developing solution which is so easily and quickly prepared.

Amidol	30 grs. (7 gms.)
Sodium sulphite, cryst.	240 grs. (55 gms.)
Potassium bromide	6 grs. (1.4 gms.)
Water, to make ...	10 ozs. (1,000 c.c.s.)

Developing Times—Dish Minutes

65°	70°	Dilution
12	10	1 Developer to 1 Water

Glycin

Sodium sulphite, cryst.	600 grs. (137 gms.)
Glycin ...	120 grs. (27.5 gms.)
Sodium carbonate cryst.	600 grs. (137 gms.)
Water, to make ...	10 ozs. (1,000 c.c.s.)

Development Times—Minutes

65°	70°	Dilution
8	6	1 : 2 DISH
15	11	1 : 4 TANK
52	40	1 : 15 TANK

Dissolve the chemicals in the above order. Glycin is only highly soluble in alkalis, therefore it will not completely dissolve until the carbonate is added.

At extreme dilutions an excess of sodium sulphite may cause fog and dichroic stain with some plates and films. In this event the sulphite should be reduced to an amount equal to that of the glycin.

Glycin is similarly susceptible to other silver halide solvents, including ammonia and its salts, hypo and the thiocyanates. It gives clean fog-free negatives of brilliance, but falls short somewhat in threshold energy. This may be compensated by adding to the above formula 10 to 15 grains of metol. For gross over-exposure, extreme dilution to 1 in 30 or 40 at a temperature of 55 degrees will give remarkable compensation. For general use no bromide should be included.

Paraminophenol

A. Paraminophenol hydrochloride ... ¾ oz. (75 gms.)
Water, hot ... 6 to 7 ozs. (600 to 700 c.c.s.)

B. Sodium sulphite (cryst.) ... 45 grs. (10 gms.)
Sodium carbonate, dry ... 150 grs. (35 gms.)
Water ... 2 ozs. (200 c.c.s.)

Filter this solution, if necessary.

Add B to A. The paraminophenol base is thrown down. When mixture is cool, filter off the deposit on cloth, and let the paste dry until its bulk is not more than 3 ozs. (300 c.c.s.).

Then, in a graduate, mix it with 1 oz. (100 c.c.s.) of soda bisulphite lye 35° B., and add strong solution of caustic soda of 40° B. (about 50 per cent.) until the base is just dissolved. Water is then added to make 5 ozs. (500 c.c.s.). The solution is diluted 20 to 30 times for use.

Paraminophenol Tropical Developer

For temperatures up to 95° F.

Sodium sulphite (cryst.) ... 2 ozs. (100 gms.)
Paraminophenol hydrochloride ... 60 grs. (7 gms.)
Sodium carbonate (cryst.) ... 2½ ozs. (125 gms.)
Sodium sulphate (cryst.) ... 2-4 ozs. (100-200 gms.)
Water, to make ... 20 ozs. (1 litre)

Development Times—Minutes

65°	75°	85°	95°
12	7	4	2½

At very high temperatures, dish development is recommended owing to the possibility of air bells. The developer should be poured quickly and evenly over the film and the dish rocked continuously. Immediately after development and *before* fixing the film should be hardened in the following solution.

Sodium sulphate cryst.	1½ ozs.	(150 gms.)
Formalin solution	3 drachms	(20 c.c.s.)
Sodium carbonate cryst. ...	¼ oz.	(20 gms.)
Water	10 ozs.	(1,000 c.c.s.)

Sodium sulphate may be added to any formula to prevent swelling of the gelatine, to the extent of 4 ounces to 20 ounces of solution. It has, however, the effect of slowing down development, and to compensate this 20 per cent. should be added to the normal times. Developer formulæ should be limited to such as will develop rapidly without fog, and for this reason highly alkaline M-Q formulæ are not the most suitable.

Without the sulphate and diluted with an equal quantity of water, the above formula is suitable for subjects where soft contrast is desired.

Pyro-Soda

B.J. Non-Staining Formula.

A.	Pyro ...	80 grs. (18.3 gms.)
	Sodium sulphite (cryst.)	1½ ozs. (150 gms.)
	Potassium meta-bisulphite	80 grs. (18.3 gms.)
	Potassium bromide	20 grs. (4.6 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)
B.	Sodium carbonate (cryst.)	1½ ozs. (150 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)

Development Times—Tank Minutes

65°	70°	Dilution
20	16	1 part A 1 „ B 1 „ Water
25	20	1 part A 1 „ B 2 „ Water
40	32	1 part A 1 „ B 6 „ Water

This old Almanac favourite has not only retained its popularity, but has increased in favour in recent years. It is entirely non-staining at normal dilutions and with full exposure and shortened development to approximately half the above maximum contrast times, soft, fully graded, enlarging negatives can be obtained.

In mixing the A solution, the sulphite and metabisulphite are dissolved first, in water that has been boiled for a few minutes, and allowed to cool to about 120° F. (48° C.). The pyro is then added slowly whilst gently stirring the solution: then add the bromide if required. Although the A solution keeps better than many other formulæ containing less sulphite protection, it is preferable to make up a quantity which can be used up in say, 6-8 weeks. However concentrated the sulphite and metabisulphite may be, oxidation of these preservatives will cause a considerable drop in pH value after long storage. Combined solutions do not keep for more than an hour or two, hence it is more economical to use small quantities in a dish which must be continuously rocked. Used in this manner, the above development times must be reduced by 30-40 per cent.

Some readers have expressed a desire to compare the present formula with the original published prior to 1934. The above can be easily converted to the old formula by omitting the bromide and reducing the carbonate from 200 grams to 165 grams. Except for a slight variation in development speed, little difference will be found in comparison if the bromide is omitted in each case.

For further information regarding the behaviour and properties of pyro generally, reference should be made to past Almanac articles: "Pyro in Modern Developers" (1941) and "Pyro—Yesterday and Today" (1949), both by R. B. Willcock. The latter article describes a 3-solution pyro-soda formula giving surface development and variable image stain, and both contain information concerning the above B.J. non-stain formula.

Metol-Pyro-Hydroquinone

B.J. Formula.

A.	Metol ...	20 grs. (4.6 gms.)
	Pyro ...	30 grs. (7 gms.)
	Hydroquinone ...	30 grs. (7 gms.)
	Sodium sulphite (cryst.)	1½ ozs. (148 gms.)
	Potassium metabisulphite	20 grs. (4.6 gms.)
	Potassium bromide	20 grs. (4.6 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)
B.	Sodium carbonate (cryst.)	1½ ozs. (150 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)

Development Times—Minutes

65°	70°	Dilution
7	5	DISH 1 part A 1 „ B 1 „ Water
13	11½	TANK 1 part A 1 „ B 4 „ Water
16	14	TANK 1 part A 1 „ B 5 „ Water

In preparing the A solution, one-fifth of the sulphite should be dissolved in three-quarters of the total bulk of hot water. In this, completely dissolve the metol, then the remainder of the sulphite, followed by the hydroquinone and bromide.

To one-quarter of the total volume of water (warm) first dissolve the potassium metabisulphite, then the pyro and add this to the solution first prepared.

An excellent developer for all subjects and equally suitable for either dish or tank development. It is non-staining and due to the pyro is particularly free from fog. With full exposure and development to times a little shorter than those given, soft negatives full of detail are obtained. Solution A will keep in good condition for a very long time with frequent opening of the bottle, and with a floating lid the combined solution will keep its energy for a week or more. Precipitation in very cold weather may be avoided by making up the solution to twice its volume.

Pyro-Metol

A.	Pyro	40 grs. (9 gms.)
	Metol	35 grs. (8 gms.)
	Potassium metabisulphite	90 grs. (20 gms.)
	Potassium bromide	15 grs. (3.5 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)
B.	Sodium carbonate (cryst.)	1½ ozs. (150 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)

Development Times—Minutes

65°	70°	Dilution
9	7½	1 part A 1 „ B 1 „ Water
12	9½	1 part A 1 „ B 2 „ Water
18	15	1 part A 1 „ B 6 „ Water

Dissolve the metabisulphite first, then the pyro and when that is dissolved add the metol.

This developer gives both detail and density quickly and the negatives are a brownish green colour, especially when the developer is highly diluted, and in consequence they possess strong printing quality. Staining is due to the intentional reduction of preservative, to which also is due the rapid deterioration of energy by oxidation when A and B solutions are combined. For this reason pyro-metol is neither suitable nor economical for tank development. Tanning action is due to oxidation stain, and may be prevented if desired by adding sodium sulphite to the A solution.

Pyro Surface Developer

For Long Scale Subjects and Halation.

Subjects of excessive contrast can often be dealt with successfully by development to low gamma with a fine grain developer or by the water-bath method. Where the contrast is very great indeed, and particularly where halation is probable a pyro developer with reduced alkali is very effective. The Kodak D-1 developer, at tank strength, with its carbonate thus reduced as below has been strongly recommended.

A. Sodium bisulphite	43 grs. (9.8 gms.)	B. Sodium sulphite (cryst.) ...	920 grs. (210 gms.)
Pyro ...	260 grs. (60 gms.)	Water ...	10 ozs. (1,000 c.c.s.)
Potassium bromide	5 grs. (1.1 gms.)	C. Sodium carbonate (cryst.)	300 grs. (70 gms.)
Water ...	10 ozs. (1,000 c.c.s.)	Water ...	10 ozs. (1,000 c.c.s.)

For use take 1½ ozs. (150 c.c.s.) each of A, B and C and dilute with water to 20 ozs. (2,000 c.c.s.). Develop 30 to 40 mins. at 65° F.

"Anhydrous" and "Crystal" Conversions

To convert:

Sodium carbonate anhyd. to cryst. multiply by 2.7.
Sodium carbonate cryst. to anhyd. multiply by 0.37.
Sodium carbonate monohydrate to anhyd. multiply by 0.855.
Sodium carbonate anhyd. to monohydrate multiply by 1.17.
Sodium sulphite anhyd. to cryst. multiply by 2.
Sodium sulphite cryst. to anhyd. divide by 2.
Hypo anhyd. to cryst. multiply by 1.6.
Hypo cryst. to anhyd. multiply by 0.625.

NOTE.—**Preparing Metol Solutions.** As Metol is easily oxidised but nearly insoluble in strong sulphite solutions, when preparing developers containing it, first dissolve a pinch of sulphite in the water at no more than 120°F., then add and dissolve the Metol. Should the metol base tend to precipitate in a concentrated stock solution, 10 per cent. of the water may be replaced by alcohol in making up the solution. Alternatively acetone may be used to an amount of 2½ per cent.

MANUFACTURERS' FORMULÆ FOR SPECIAL PURPOSES

	D-72	D-19b	D-158	D-163	DK-50	ID-2	ID-62	ID-36	ID-20	
Metol	3.1	2.2	3.2	2.2	2.5	2	—	3	3	gm.
Hydroquinone ...	12	8.8	13.3	17	2.5	8	12	12.5	12	,,
Phenidone ...	—	—	—	—	—	—	0.5	—	—	,,
Sodium sulphite (cryst.) ...	90	144	100	150	60	150	100	100	100	,,
Sodium carbonate (cryst.) ...	180	130	186	175	—	100	162	187.5	160	,,
Kodalk	—	—	—	—	—	—	—	—	10	,,
Ilford IBT Restrainer soln.	—	—	—	—	—	—	20	—	—	c.c.
Potassium bromide	1.9	4	0.9	2.8	0.5	2	2	0.75	4	gm.
Water to	1	1	1	1	1	1	1	1	1	litre

D-72 (Kodak).—A universal developer suitable for plates, films and papers. The following dilutions with water are given by Crabtree and Matthews. Press negatives, 1 : 1, dish 4 mins., tank 5 mins. Bromide papers, 1 : 4, 1-1/2 mins.

D-19b (Kodak).—A high contrast developer for X-ray and aero films, also useful for general industrial photography. Used undiluted at 68°F., the average time for tank development is 5 mins. Suitable also for photomechanical and document materials. A well balanced developer of good keeping properties.

D-158 (Kodak).—Primarily the developer for "Velox" paper. Recently recommended by Kodak Ltd., as a developer for photomechanical and document copying materials replacing D-154. Dilute 1 : 1 for use with above materials.

D-163 (Kodak).—Mainly a bromide and chlorobromide paper developer, replacing the old D-157 formula. For papers and lantern plates it is used diluted 1 : 1, 1 : 2 or 1 : 3 according to the brilliance or contrast required, development times being from 1-1/2 to 2 mins. at 68°F. Useful also as a negative developer diluted 1 : 3, giving good contrast and brilliance. Develop 4-6 mins. in a dish and 5-8 mins. in a tank at 68°F.

DK-50 (Kodak).—A normal contrast developer suitable for all types of plates and films. Particularly suitable for commercial and engineering subjects. Clean working and fog free, giving excellent gradation on super-speed plates and films. The presence of "Kodalk" as the alkali prevents hot weather blistering of the emulsion in the acid fixing bath. Use without dilution at 68° F. and develop for about 3 minutes.

ID-2 (Ilford).—The standard M.Q. developer for films and plates, and a non-caustic developer for high contrast graphic arts films and plates. For normal use dilute 1: 2 dish and 1 : 5 tank. For line and screen work use at stock solution strength.

ID-62 (Ilford).—A general purpose P.Q. formula for films, plates, and papers. Contains no metol. For films and plates dilute 1 : 3 dish and 1 : 7 tank. For contact papers, contact and special lantern plates dilute 1 : 1. For enlarging papers and warm-black lantern plates dilute 1 : 3.

ID-36 (Ilford).—A universal M.Q. developer for films, plates, and papers. Recommended as the standard formula for contact papers and for Ilford Contact and Special Lantern Plates. For films and plates dilute 1 : 3 dish and 1 : 7 tank. For contact papers, Contact and Special Lantern Plates dilute 1 : 1.

FINE GRAIN DEVELOPMENT

Probably one of the best indications of the success of a formula, group of formulæ, or some special technique is to note the acceptance or rejection of such by workers of the highest status. This is particularly true of miniature photography, in so far as the developing technique of foremost exponents gives an accurate indication of modern successful trends. By such indications it would appear that only a relatively small number of well-tried and therefore reliable formulæ have survived the very many which have appeared from time to time in recent years. It is significant to note that most of those successfully used to-day are comparatively recent introductions, as for example the various formulæ containing Meritol, and others introduced by leading manufacturers of sensitive material. These excellent formulæ, producing as they do really good gradation with a minimum of emulsion speed loss, have caused a decline in popularity of p-phenylenediamine with its many disadvantages. Physical development, too, has dropped somewhat into the background.

The classification of fine grain formulæ remains, however, practically the same, viz.: (1) Developers of medium fine grain, such as Agfa 14 and 15, Kodak D.76 and the same firm's latest D.23; (2) Superfine grain developers containing a special developing agent such as p-phenylenediamine or Meritol, and those containing a normal type of developing agent modified in respect of concentration and supporting ingredients introduced to reduce grain size. Of this latter type are the Kodak formulæ DK.20 and the latest D.25. All true fine grain developers have the common characteristic of low alkaline energy which rarely exceeds about pH8.8. Beyond this value most developing agents, even p-phenylenediamine and Meritol, leave the ranks of fine grain developers and operate more or less normally according to their respective reduction thresholds. p-phenylenediamine and Meritol possess inherently fine grain properties, requiring ordinarily no other aid, but formulæ containing metol and hydroquinone, as for example, D.76 and others containing metol alone, as in DK.20, D.23, etc., depend largely on a silver halide solvent, usually an excess of sodium sulphite, which is occasionally combined with a small quantity of a more powerful solvent such as potassium thiocyanate or an amine. Halide solvents prevent the clumping or fusing of silver grains during development, which fusion if not prevented will add materially to grain size. Other factors must, however, be taken into consideration. For example, the relation between concentration of the reducing agent, silver halide solvent, and pH value is of vital importance, and developing times are usually critical for maximum fineness of grain. Over-development, particularly in the case of developers containing a powerful silver halide solvent, such as DK. 20, or p-phenylenediamine with a high sodium sulphite content, may result in a heavy layer of colloidal silver (a variety of dichroic fog), a fact noted by R. W. Henn and J. I. Crabtree in their Kodak Research Report describing the new formulæ D.23 and D.25. Such physically removed silver is said by these investigators to give a diffused effect or lack of sharpness, which in the latest D.25 formula is practically eliminated. "Microdol"—the latest Kodak fine-grain developer—is again of advantage in this respect. In addition it does not form a scum on exhaustion, exposure to air or on replenishment: it has little tendency to precipitate in hard water and produces notably low fog even with forced development : it has a long working life which can be extended by simple replenishment: and the increase in exposure which it calls for is unusually small and can generally be neglected. Its activity is very similar to that of DK.20—so that developing times are reasonably short—and it is economical in use. It possesses the further advantage that it can be converted into a developer in the ultra-fine-grain class merely by an addition of Kodak Anti-fog Solution. Meritol is deservedly popular by reason of its versatility, and is capable of producing negatives comparable with p-phenylenediamine, but without its toxicity and other disadvantages. It should be noted that a number of so-called fine grain developers are really highly diluted normal types of slightly reduced energy, which with curtailed development to a gamma of, say, 0.6 to 0.8 following correct exposure, will give a medium fine grain with a high degree of resolution.

The choice of a fine grain developer depends largely on the type of emulsion favoured and the degree of enlargement desired. Many leading workers prefer as often as possible to use a naturally fine grain emulsion of about 27 to 29 deg. B.S.I. processed in say D.76 or similar type medium fine grain developer. Others choose a rapid, relatively coarse grained emulsion, with the slight increased exposure demanded by certain superfine grain developers. The true seeker after fine grain, however, will undoubtedly adhere to an inherently fine grain emulsion developed in a superfine grain formula such as Meritol, DK.20 or D.25. For high speed press photography with a minature camera, the choice is often a superspeed film of 32 deg. B.S.I. or more, the full emulsion speed of which is required to be maintained in a high threshold medium fine grain formula of the D.76 class.

Attention is drawn to the various two-bath methods which have culminated in the latest Meritol-caustic technique. Disregarding many exaggerated claims made in respect of this last-named method, it is capable of dealing successfully with known underexposure, particularly in high contrast subjects, and may in certain cases virtually increase slightly the ordinary emulsion speed.

Considerable care is required in the mixing of fine grain formulæ, regardless of whether they are weighed out from bulk chemicals or purchased ready packed. Water filtered from all grit and sediment should always be used, or preferably distilled water which has been boiled for several minutes to neutrality (pH7.0).

The formulæ below are selected from a very large number published in recent years, and if used correctly will produce negatives of the very highest standard in regard both to grain size and quality.

MEDIUM FINE GRAIN DEVELOPERS

Containing Metol, and Metol and Hydroquinone

This class broadly includes those maintaining fully, or nearly so, the maximum rated speed of the emulsion with some slight sacrifice of grain as compared with superfine grain formulæ. Used with inherently fine grain emulsions of medium speed, grain size will be approximately that of coarser grain, rapid films, developed in a superfine grain formula. Agfa 14 and 15 are two surviving favourites, the last-named being a modification of Agfa 14 giving slightly more contrast. D.76 is Capstaff's well-known formula, of which D.76b is a modification yielding a softer image. D.76d, known as buffered borax, is another modification of slightly finer grain than D.76, compared with which it does not give quite the full emulsion speed. D.76d is largely used in motion picture work.

	1	2	3	4	5	
	Agfa 14	Agfa 15	D.76	D.76b	D.76d	
Metol	4.5	8.0	2.0	2.75	2.0	gms.
Hydroquinone	—	—	5.0	2.75	5.0	,,
Sodium sulphite (cryst.) ...	170.0	250.0	200.0	200.0	200.0	,,
Sodium carbonate (cryst.) ...	2.6	31.0	—	—	—	,,
Borax	—	—	2.0	2.05	8.0	,,
Boric acid	—	—	—	—	8.0	,,
Potassium bromide	0.5	1.5	—	—	—	,,
Water to	1	1	1	1	1	litre

Development Times.—Nos. 1, 3 and 4 are approximately the same as for DK.20, whilst No. 2 requires about 25 per cent. less than these times and No. 5 25 to 50 per cent. more. Developing times for DK.20 and D.76 are given on pages 268-269.

SUPERFINE GRAIN DEVELOPERS

(Containing Metol)

This group of superfine grain developers worked out by R. W. Henn and J. I. Crabtree of the Eastman Kodak Research Laboratory are outstanding examples of modern fine grain formulæ. Scientifically designed, they give excellent gradation combined with minimum grain size, which in the case of DK.20 and D.25 is very little if any inferior to a p-phenylenediamine-sulphite formula. All are economical in working and initial cost.

DK.20.—Introduced in 1938, this formula is of the low alkalinity type containing potassium thiocyanate in addition to an excess of sodium sulphite as a silver halide solvent. Compared with D.76, an increase in exposure of about 20 per cent. is required equal to about 1/2 camera stop larger. Gives some density depression at upper shoulder of characteristic curve. Gamma recommended 0.7 to 0.8.

D.23.—This developer falls between the medium and superfine grain groups: giving rather finer grain than D.76. Gives about 90 per cent. of emulsion speed, but has greater over-exposure latitude since the upper part of the characteristic curve does not shoulder off. Consequently, there is less density depression at higher values and visual gamma is higher (more constant). Some over-development gives greater contrast without undue increase of grain size. Recommended gamma 0.8 to 0.9.

D.25.—Introduced in 1944, at the same time as D.23, this exceptionally fine formula gives the very finest grain possible without using a special developing agent such as p-phenylene-diamine which it is said to equal in this respect with less emulsion speed loss. D.25 operates at neutrality (pH7.0, obtained by buffering the sulphite with sodium bisulphite). The characteristic curve is straight as in D.23 and the negatives are proportionately graded. Emulsion speed obtained is 50 to 60 per cent. less than with D.76 and so requires about 1 camera stop larger, i.e. rather more than with DK-20. It is important to note that the developing temperature must be maintained at 77°F. Gamma recommended 0.7 to 0.8.

	1	2	3	
	DK.20	D.23	D.25	
Elon (or metol)	5	7.5	7.5	gms.
Sodium sulphite, anhydrous ...	100	100	100	,,
Kodalk	2	—	—	,,
Potassium thiocyanate ...	1	—	—	,,
Sodium bisulphite	—	—	15	,,
Potassium bromide	0.5	—	—	,,
Water	1	1	1	litre

Developing times for above three developers at 68°F. (20°C.) for DK.20 and D.23; and at 77°F. (25°C.) for D.25 are given on pages 268-269.

MERITOL SUPERFINE GRAIN DEVELOPERS

All developers containing Johnson's Meritol rank as superfine grain types, although grain size varies slightly according to the composition of individual formulæ.

No. 1.—Containing Meritol and sodium sulphite only, confers the finest grain of the group and requires sensitive materials to receive about 50 per cent. more than normal exposure, although in the case of under-exposure quite good results can be obtained by longer development which does not materially increase grain size.

No. 2.—Meritol-Metol. As with No. 1, this formula requires that sensitive materials shall have about 50 per cent. more exposure than normal, but the chief advantage of Meritol-Metol is its rapidity, development times for which are only half those of No. 1.

No. 3.—M.C.M. 100. As introduced by the Miniature Camera Magazine, this formula combines exceptionally fine grain with good developing speed which is midway between Nos. 1 and 2. It gives high threshold expression and requires no increase over normal exposure. Under-exposures are satisfactorily dealt with by increased developing times.

Important Note.—It is emphasised that the backing on certain roll films has a restraining effect on Meritol development, hence such films should be given a preliminary soaking in plain water for about three minutes with agitation. This treatment does not affect development times.

Formulæ Containing Meritol

	1	2	3	
	Superfine grain	Meritol metol	M.C.M. 100	
Meritol	16	13.7	16	gms.
Metol	—	2.3	—	,,
Sodium sulphite (cryst.)	180	180	176	,,
Tribasic sodium phosphate (anhyd.)	—	—	2.9	,,
Borax	—	—	2.3	,,
Potassium bromide, 10% solution...	—	—	2.5	c.c.s.
Water	1	1	1	litre

Developing Times at 70°F.

Johnson's Group	1	2	3	4	5	6	7	
Superfine grain	9	10½	12	13½	16½	19½	24	minutes
Meritol metol...	5	5½	6	7	8½	10	12	,,
M.C.M. 100 ...	8	9	10	12	16	18	20	,,

Note.—M.C.M. 100 may be used diluted. If one part of the concentrated solution is diluted with 9 parts of water, development should be increased to 3 times the normal time.

See pages 268-269 for Johnson's Group List.

OTHER PROPRIETARY FINE GRAIN DEVELOPERS

Promicrol. May & Baker Ltd.

This ultra-fine grain developer powder contains an entirely new combination of developing agents. Aided by the discriminate use of some silver halide solvent " Promicrol " is said to give negatives hardly distinguishable from p-phenylenediamine. Used for correctly exposed films it attains full emulsion speed, but owing to a pronounced property of emphasising shadow detail without adversely affecting other tones " Promicrol " deals successfully with under-exposure. In practice, this means that exposures based on double the normally quoted emulsion speed ratings will give adequately exposed negatives with satisfactory shadow detail. Unused working solution will keep several months in full bottles kept away from the light. An interesting booklet " Fine Grain Development " is issued gratis by the makers, and deals with methods of using this developer economically at various dilutions. Typical characteristic curves are also given.

Development times at 68°F. (20°C.) for gamma values of 0.6, 0.7 and 0.8 for a variety of materials are given on page 270.

Unitol. Johnsons of Hendon Ltd.

A concentrated liquid fine grain developer introducing a new system of development based on the idea of using 1 ounce of fresh developer to specified volumes of water, and discarding the solution after using *once only.* For dilutions giving total volumes of 6, 10, 16 and 20 ounces of working solution developing times are given below, but for a complete range of such dilutions up to 25 ounces a special calculator is available from the makers, price 4d. On no account should restrainers or " improvers " be added to this developer. Keeping qualities of " Unitol " are excellent, and the loss of emulsion speed is approximately half a stop.

The following tank times are for agitation of 10 seconds every minute up to 20 minutes, and over that time once every two minutes. The developing times given below are for negatives of good enlarging quality from average contrast subjects.

Developing times at 70°F. (21°C.). For Johnson's group list see pages 268-269.

Minutes

Johnson's Group	1	2	3	4	5	6	7
1 oz. to 5 ozs. water = 6 ozs. (dish)	3¼	3¾	4¼	5	6	7	8½
1 oz. to 9 ozs. water = 10 ozs. (tank)	5	5¾	7	8¼	9¾	11½	13¾
1 oz. to 15 ozs. water = 16 ozs. (tank)... ...	8	9¼	11	13	15½	18½	22
1 oz. to 19 ozs. water = 20 ozs. (tank)... ...	10	11¾	14	16½	19½	23	27

Microdol. Kodak Limited.

An extremely fine grain developer giving minimum effect on emulsion speed. It has little tendency to form a sludge and has a very low fog level even with forced development of fine grain films. " Microdol " produces a slightly brownish image tone giving greater printing contrast than is apparent to the eye. It keeps in good condition for several months in a tightly corked bottle.

Developing times for Kodak films and plates at 68°F. (20°C.) are given on pages 268-269.

Johnson's Fine Grain Developing Powder

Suitable for all types of 35 m/m films, roll films and plates which may be enlarged up to eight diameters without noticeable grain. No increase in exposure is necessary.

Burroughs Wellcome ' Tabloid ' Brand Fine Grain Developer

Yields fine grain negatives without the necessity of increasing exposure and allows enlargements up to 10 diameters.

Developing times at 70°F. (21°C.), minutes.

Johnson's Groups	1	2	3	4	5	6	7
Johnson's Fine Grain Developing Powder ...	5	5½	6½	7½	9	11	13
' Tabloid ' Fine Grain Developer:							
1 pair of products in 2 ozs. (57 c.c.s.) water	2½	2¾	3¼	3¾	4½	5½	6½
1 " " " " 4 " (115 c.c.s.) "	5	5½	6½	7½	9	11	13

Burroughs Wellcome 'Tabloid' Brand Fine Grain Developer.

If instead of using water only in the above "Tabloid" fine grain developer, 1 pair of products are dissolved in each 2 ozs. of water and an equal volume of 20 per cent. sodium sulphite solution added, a developer giving much finer grain is produced.

Developing times at 70°F. (21°C.), minutes.

Johnson's Groups	1	2	3	4	5	6	7
Developing times	6	6½	8	9	11	13	15½

See pages 268-269 for Johnson's Group list.

PARAPHENYLENEDIAMINE DEVELOPERS

The standard paraphenylenediamine (P.P.D.) developers, as published by Dr. Sease, are as follows:

	1	2	3	4	
P.P.D.	10	10	10	10	gms.
Glycin	—	1	6	12	,,
Sodium sulphite (cryst.) ...	180	180	180	180	,,
Water	1	1	1	1	litre

No. 1 requires at least four times normal exposure; No. 4 but little more than normal, and the others an intermediate increase. Development times vary, of course, according to film group, but for such as are presented by Kodak Panatomic X and Ilford H.P.3 cut films, suggested trial development times at 65°F. are 45, 30, 22 and 22 minutes respectively.

RECENT SPECIAL FINE GRAIN DEVELOPERS

Two proprietary fine grain developers which call for special mention have appeared during the past year. Both are notable in that they give very fine grain without loss of emulsion speed, but in other respects they behave very differently, and their possibilities have so far been by no means fully explored.

Ergol (Photax Ltd.) possesses the advantage that it can be used at a high temperature and developing times are short. It is claimed that it enables some super-speed pan films to be exposed at six times their rated speed. Tests in the *B.J.* laboratory showed that development of a fast pan film in Ergol for 12 minutes at 77°F. will give an emulsion speed identical with that obtained using D.23 for 15 minutes at the same temperature. It may be justly claimed that Ergol enables considerably increased speed rating to be used with short developing times.

The following table, taken from the instructions issued with Ergol developer, show the increased speeds for a number of materials by developing at 77°F. with continual gentle agitation for the times stated. Full instructions are issued, and these should be carefully followed, particularly as regards hardening after development, in view of the softening effect of the high temperature.

Film	Rated Weston Speed	Weston Speed using Ergol	With development time of mins.	Film	Rated Weston Speed	Weston Speed using Ergol	With development time of mins.
Ilford Pan F	16	24 48 64	4 5 7–8	Agfa Isopan F	25	32 64 125	3 4 6
Ilford FP3	50	80 100 200 400	5 6 7 9	Agfa Isopan ISS	64	125 350 500	4½ 5 9
Ilford HP3	125	200 400 600 800	5 7 9 10–12	Ferrania Super Pan P.3	24	32 80 125	3½ 4 6
Kodak Pan X	24	32 50 100 200	4 5 7 9	Ferrania Super Pan S.2	100	160 200 400 800	6½ 7–8 9 11
Kodak Plus X	50	100 200 400	3 4–4½ 7	Gevaert Micropan	24	32 80 125	5 6 9
Kodak Super XX	100	200 400 600	4 7 9	Gevaert Panchromosa	100	160 200 250	9½ 10 11
Agfa Isopan FF	5	10 20 40 50	2 2½ 3 4	Dufay Pan 29°	50	80 100 200 400	4 5 6 8

Capitol (Johnsons of Hendon Ltd.) is chiefly notable for the fact that long continued development with it, while certainly it increases the graininess, does not result in excessive contrast. Consequently when used with normal exposures, and even exposures which are under exposed by ordinary standards, Capitol gives fine grain and a negative of excellent printing quality in which, on account of its long, straight characteristic curve, highlights do not block up even on high contrast subjects; with extreme under exposure on the other hand long continued development with Capitol gives still a printable negative at the sacrifice of some degree of fine grain, but with little increase of contrast. Capitol will thus handle very well subjects of long tone range which have been given the very minimum of exposure in order to save the highlights. In particular, the selective effect of Capitol in bringing up shadow detail is one of its special advantages. The following table, taken from the instruction sheet, gives the development times with a number of materials found to give the increased speed ratings shown. Column A shows the meter settings found to give negatives of similar quality to those obtained by normal M.Q. Borax development following exposure at the makers' speed rating. Column B is intended as a basis for experiment when the utmost speed is required: they are based on actual tests, but users are advised to confirm them with a few test exposures under their own conditions.

FILM (with Maker's official Speed Rating in °B.S.)		Developing Times Mins. at 68°F.(20°C.)		Exposure Meter Settings for use with Capitol	
		Dilution 1+4	Dilution 1+7	A Normal Settings	B Settings for poor light, etc.
AGFA					
Isopan ISS (RF) ...	30°	8 to 16	10 to 20	33°/160 35°/250	36°/320 38°/500
FERRANIA					
Super Pan P.3 (35 mm.)	26°	10 to 20	13 to 26	30°/80 33°/160	33°/160 36°/320
Super Pan S.2 (35 mm.)	30°	8 to 14	11 to 18	34°/200 37°/400	37°/400 40°/800
Super Pan 32° (RF)	31°	9 to 18	11 to 23	34°/200 39°/650	37°/400 42°/1250
GEVAERT					
Gevapan 33 (35 mm.)	32°	7 to 14	9 to 18	36°/320 38°/500	39°/650 41°/1000
Gevapan 33 (RF) ...	32°	14 to 27	20 to 35	36°/320 39°/650	39°/650 42°/1250
Gevapan 30 (RF) ...	29°	12 to 25	15 to 32	33°/160 36°/320	36°/320 39°/650
Gevapan 27 (35 mm.)	26°	13 to 25	17 to 33	29°/64 32°/125	32°/125 35°/250
Gevapan 27 (RF) ...	26°	12 to 22	15 to 28	29°/64 33°/160	32°/125 36°/320
Gevachrome (RF)	29°	9 to 18	11 to 23	32°/125 35°/250	35°/250 38°/500
KODAK					
Super XX (RF)	31°	8 to 13	10 to 17	34°/200 36°/320	37°/400 39°/650
Plus X (35 mm.) ...	29°	8 to 17	10 to 22	31°/100 33°/160	34°/200 36°/320
Plus X (RF)	29°	6 to 11	8 to 15	32°/125 34°/200	35°/250 37°/400
Verichrome (RF) ...	28°	8 to 15	10 to 20	31°/100 33°/160	34°/200 36°/320
ILFORD					
HP3 (35 mm.)	32°	11 to 22	14 to 28	35°/250 38°/500	38°/500 41°/1000
HP3 (RF)	32°	15 to 30	20 to 40	35°/250 39°/650	38°/500 42°/1250
FP3 (35 mm.)	29°	11 to 22	14 to 28	32°/125 35°/250	35°/250 38°/500
FP3 (RF) ...	29°	15 to 30	20 to 40	33°/160 36°/320	36°/320 39°/650
Pan F (35 mm.)	23°	10 to 18	13 to 24	25°/25 27°/40	28°/50 30°/80
Selochrome (RF) ...	30°	10 to 20	13 to 26	34°/200 37°/400	37°/400 40°/800

PSEUDO-FINE GRAIN DEVELOPERS

Almost any normal negative developer will give medium fine grain development if diluted sufficiently, that is, to an extent permitting slow, surface development, which prevents grain fusion or clumping to some extent. Half a century ago, inherently high contrast of plates was controlled in this manner, hence the reduction of grain accompanying such a method was not then of first importance.

The modern application consists of diluting an M-Q or metol developer so that a gamma of, say, 0.6 to 0.8 is attained in 30 minutes or more. The Pyro Surface Developer given under "Negative Developers" is in every way suitable, and the upper density depression, or "shouldering off" resulting produces negatives very suitable for enlarging. The water bath method, too, gives upper density control with some reduction of grain size.

TWO-BATH FINE GRAIN DEVELOPERS

The two-bath formulæ in vogue to-day for fine grain development with reduced contrast and low gamma are lineal descendants of the original Kodak SD.4 formula introduced by Crabtree, Parker and Russell in 1933, in which an M-Q formula without alkali and acidified to inertness was used as a fore-bath prior to immersion in a second alkaline bath to complete development. The same basic method applied to fine grain development is employed in the following formulæ:

The Symon Two-Bath Method.—Col. W. C. Symon advocated a fore-bath consisting of DK.20 from which the Kodalk had been omitted. The alkaline second bath then consists of a 0.2 per cent. solution of Kodalk. For contrast subjects, this method has many advantages and in addition gives development without emulsion speed loss. Distilled water is recommended in compounding the solutions. Development times for a gamma of 0.7 at 65°F. are in the fore-bath: Panatomic-X 6½ minutes, Plus-X 10 minutes, Super-XX and HP3 15 minutes.

In each case the immersion time in the alkaline "B" bath is 3½ minutes.

The Leica Two-Bath Formula.—To obtain the greatest possible sharpness without loss of emulsion speed, the "Leica News" recommended the following formula:

Solution A		**Solution B**	
Metol	5 gms.	Sod. sulphite (anhyd.) ...	6 gms.
Sod. sulphite (anhyd.)	100 gms.	Sod. carbonate (anhyd.) ...	15 gms.
Water	1,000 c.c.s.	Water, to make ...	1,000 c.c.s.

Development at 65°F. should be for 2 to 4½ minutes in Solution A, according to class of film, followed by 3 minutes immersion in Solution B. For finer grain and steeper contrast, give about 16 minutes in Solution A and omit B bath altogether. For fine grain with possibly some loss of emulsion speed, substitute a 1 per cent. solution of borax for B bath keeping to the same development times.

Meritol Caustic Two-Bath Method for Under-Exposures.—First mentioned in the Miniature Camera Magazine (February 1943) this technique follows the usual two-bath practice, the difference being that the fore-bath A consists of the regular Meritol Superfine Grain formula already given, followed by a powerful second, or B bath consisting of a dilute solution of caustic soda: 30 c.c.s. (1 oz. 30 minims) of 10 per cent. sodium hydroxide solution in 450 c.c.s. (16 oz.) of water. The sequence of operations for development in the film tank are: (1) Load film into tank; (2) Pour in necessary quantity of working strength A solution; (3) Agitate for 3 minutes; (4) Pour out solution A and without rinsing, pour in necessary quantity of working strength B (caustic) solution; (5) Agitate for 3 minutes; (6) Pour away caustic solution (now a bright purple); (7) Fix in an *acid hardening* fixing bath, wash and dry. Plates may be dish developed in a similar manner to that just given for 35 mm. film, but the coloured backing of most roll films has a restraining action on Meritol, and should be removed before development by soaking the film for 1 minute, with agitation, in a 1 per cent. solution of anhydrous sodium sulphite. This procedure necessitates six minutes immersion in the Meritol A fore-bath, in place of the customary three. The contrast of negatives produced by Meritol Caustic depends on the type of film and on the concentration of Meritol in the first A bath. Made up to 450 c.c.s. working solution with water, the volumes of Meritol stock solution vary from 115 c.c.s. (4 oz.) to 325 c.c.s. (11½ oz.) respectively for soft and contrasty results. For full details, however, see special booklet on the subject issued gratis by Johnsons of Hendon Ltd.

Special Note.—Keep all processing solutions at one temperature, preferably 60° to 70°F.; variations may cause reticulation. The Meritol solution may be used for processing 3 or 4 35 mm. films per 450 c.c.s. (16 oz.), but the caustic solution must be used only once.

PHYSICAL DEVELOPMENT FOR FINE GRAIN

Odell's Revised Formula

This method for normal exposures consists of the following stages:—(1) Immersion in the fore-bath; (2) Development in the silver solution and customary fixation in an acid hardening fixing bath. Dishes and tanks must be of material which does not encourage silver deposit, viz., stainless steel or chromium, although glass, rubber or synthetic resin dishes are suitable. The requisite baths are as follows:

Fore-Bath Solution	
Potassium iodide ...	5 gms.
Sod. sulphite (anhyd.) ...	12.5 gms.
Water, to make	500 c.c.s.

Silver Stock Solution	
Sod. sulphite (anhyd.) ...	50 gms.
Silver nitrate (cryst.)	8 gms.
Hypo (fresh crystals)	80 gms.
Water, to make ...	500 c.c.s.

To mix silver stock solution, dissolve all sulphite in 250 c.c.s. of water; dissolve silver nitrate in 200 c.c.s. of water. Add silver solution to sulphite solution and stir until precipitate formed is completely dissolved. Then add hypo crystals with stirring until all are dissolved, finally filtering the solution if necessary. This stable solution is not light-sensitive and may be stored in any kind of bottle. The silver working solution consists of 100 c.c.s. of stock silver solution made up to 500 c.c.s. of water. About 10 minutes before use add to this silver solution 0.75 grams of amidol which must be thoroughly stirred in to dissolve it.

Developing Procedure.—With temperature maintained throughout at 65°F., proceed as follows: (1) Load film into tank, and pour in fore-bath, which is allowed to act for 3-4 minutes. (2) Rinse film well in two changes of water and pour in silver working solution, which *must be used only once*. Development in the silver bath requires 25 to 30 minutes with agitation at intervals. (3) Pour off solution and rinse with clean water before pouring in hardening fixing solution, which step should require about 20 minutes in a fresh bath, or up to an hour for a bath that has been used four or five times. After washing, and before drying, the film should be lightly swabbed over with wet cotton wool, and any surplus water absorbed with viscose sponge.

Special Note.—Only anhydrous sodium sulphite of the very highest quality should be used for preparing the silver stock solution. If after standing for about 10 minutes, the silver *working solution* has a decided opalescent or cloudy appearance, it is normal and in proper working order and may be used without fear.

HARDENING SHORT STOP AND HARDENING FIXING BATHS FOR MINIATURE FILMS

The following formulæ, whilst equally applicable to all negatives, are especially recommended for the more exacting requirements of the miniature film. Standard formulæ for general purposes will be found in subsequent pages.

Hardening Short Stop

(To be made up fresh and discarded after use.)

Chrome alum	20 gms.
Water	1 litre

When dissolved, add, with agitation until dissolved,

Sodium bisulphite ...	20 gms.

Fixing

After 5 minutes immersion in the above, transfer to the following acid hardening fixer:

Hypo	300 gms.
Water	1 litre

to which add slowly, with vigorous agitation, 250 c.c.s. of the following stock hardening solution:

Sod. sulphite (cryst.)	150 gms.
Acetic acid 28%	235 c.c.s.
(or glacial... ...	65 c.c.s.)
Boric acid (cryst.) ...	37.5 gms.
Alum	75 gms.
Water, to make ...	1 litre

Dissolve in the order given.

Reducing the Grain of a Negative

The coarseness of grain of a finished negative may be considerably reduced by a method described by A. Seyewetz. The negative is first treated in 10 per cent. potassium ferricyanide solution with or without the addition of 0.5 per cent. of ammonium thiocyanate, and re-developed in the following developer:

p-phenylene diamine	10 gms.
Sodium sulphite (anhyd.)	60 gms.
Water to make	1 litre

Contrast and speed are only slightly decreased.

Retouching and Filling Scratches and Cleaning Film

If the image itself is abraded, take a spoiled negative, lay it in the least possible amount of hot water until the gelatine of the negative is dissolved. Allow the solution to cool until it is barely luke-warm, then use it to fill up scratches and pinholes.

If the image is undamaged, scratched film negatives can be made to give enlargements free from scratch marks by sandwiching in glycerine between glasses, or miniature negatives may be cemented between glasses using the minimum of canada balsam.

Dirty, dusty and greasy film may be cleaned by well moistening with the following film cleaner, using chamois leather or viscose sponge, taking care to clean both sides and using light pressure. When the film is dry, which should be in about 10 minutes, polish with dry chamois leather.

Film Cleaner.	Acetic acid	1 part
	Vaseline	5 parts
	Carbon tetrachloride	100 parts

There are also available excellent commercial preparations which simultaneously fill up scratches so that they no longer appear on the enlargement (provided the image itself is not injured) and also considerably harden the film against further damage by abrasion.

PAPER NEGATIVES FOR REFLECTION PRINTING

(The following details are abstracted by courtesy of Granville Gulliman Ltd. from a leaflet published by them on the processing of their paper films.)

Paper films are developed in similar fashion to celluloid films. The following formula is recommended:

Metol ...	160 grs. (10 gms.)
Hydroquinone	320 grs. (20 gms.)
Sodium sulphite (cryst.)	12 ozs. (340 gms.)
Sodium carbonate (cryst.)	8 ozs. (gms. 227)
Potassium bromide	160 grs. (10 gms.)
Water, to make	1 gal. (4.5 litres)

Develop by inspection (3 mins. at 65°F. is the normal time) and remove any over-exposed negatives to the fixing bath. Correctly developed negatives look rather grey but print well; fully developed negatives will prove unprintable. By the red darkroom light, the negatives should not have the dense black appearance of celluloid films but should be somewhat similar to bromide prints.

Over-exposed negatives may be reduced in dilute Farmer's reducer, but considerable care is necessary.

Fixing, washing and drying are as for celluloid film, but paper negatives must not be glazed.

Printing is by reflection, on bromide paper, using special reflection printers. Extra contrast may be obtained by the use of a developer such as:

Solution A.

Hydroquinone	5½ ozs. (32 gms.)
Sodium bisulphite	5½ ozs. (32 gms.)
Potassium bromide	1½ ozs. (8 gms.)
Water, to make ...	1 gallon (1 litre)

Solution B.

Caustic soda	10 ozs. (60 gms.)
Water, to make ...	1 gallon (1 litre)

For use, take equal parts of A and B.

FIXING, HARDENING, DRYING

FIXING AND HARDENING BATHS

Stock Hypo Solution.—A convenient method of keeping hypo is: Dissolve each pound (500 gms.) in about 20 ozs. (600 c.c.s.) of hot water, cool and make up to 32 ozs. (1 litre). Every 2 ozs. (100 c.c.s.) of this stock solution contains 1 oz. (50 gms.) of hypo.

For Fixing Prints.—Take 8 ozs. (400 c.c.s.) stock solution and make up to 20 ozs. (1 litre) of water, equal to 1 part hypo to 5 parts water.

For Fixing Plates and Films.—Use as for prints, but preferably stronger, *i.e.* 1 part hypo to 3 or 4 parts water.

Extra Rapid Fixing.—Mainly used for X-ray and oscillograph negatives. To a fixing bath containing 5 to 6 ozs. (250 to 300 gms.) per 20 ozs. (1 litre) of water, add $\frac{1}{2}$ to $\frac{3}{8}$ oz. (25 to 20 gms.) respectively of ammonium chloride, or commercial sal ammoniac. A bath so composed fixes in about half the usual time. The above bath may be acidified by the addition of $\frac{3}{8}$ oz. (20 gms.) of potassium metabisulphite or sodium bisulphite.

Acid Fixing Bath.—Add $\frac{1}{2}$ oz. (25 gms.) of potassium (or sodium) metabisulphite to each 20 ozs. (1 litre) of plain hypo working solution. This is the most satisfactory formula we know for plates and papers. It keeps clear and stainless to the last and does not precipitate sulphur. Metabisulphite must not be added to hot hypo solution.

Hardening-Fixing Baths

No. 1

A.	Hypo	5 ozs. (250 gms.)
	Water, to make	20 ozs. (1,000 c.c.s.)
B.	Sodium sulphite (cryst.)	2 ozs. (100 gms.)
	Acetic acid glacial	3 ozs. (fl.) (150 c.c.s.)
	Alum ...	2 ozs. (100 gms.)
	Water (warm), to make	20 ozs. (1,000 c.c.s.)

Dissolve the sulphite in 5 ozs. (250 c.c.s.) of warm (not hot) water and allow to cool, then add the acetic acid little by little, stirring all the time. Dissolve the alum in 10 ozs. (500 c.c.s.) of hot water, allow to cool and add the sulphite and acid mixture. It is important that the mixing of these solutions be done at a temperature not exceeding 70°F. (20°C.). Finally make up to 20 ozs. (1,000 c.c.s.) with cold water.

To make the fixing-hardening bath, 2 parts of the B (hardener) solution are added to 20 parts of the A (hypo) solution.

No. 2

A.	Water (hot)	15 ozs. (750 c.c.s.)
	Hypo	6 ozs. (300 gms.)
	Sodium sulphite (cryst.)	260 grs. (30 gms.)
B.	Water (warm)	5 ozs. (250 c.c.s.)
	Chrome alum	130 grs. (15 gms.)
	Sulphuric acid, pure concentrated s.g. 1.84.	20 mins. (2 c.c.s.)

Dissolve the chrome alum in warm (not hot) water, and when the solution is cold add the sulphuric acid slowly. This solution B, when cold, is then added, with stirring, to the hypo solution A, which must also be cold. This is a good all-round formula for plates, films and papers, although like all chrome alum baths hardening power gradually declines. If a chrome alum stop bath is not used, all materials should be well-rinsed in water before fixing.

No. 3

Hypo	... ...	6 ozs. (300 gms.)
Potassium metabisulphite		½ oz. (25 gms.)
Chrome alum	...	¼ oz. (12.5 gms.)
Water	... ...	20 ozs. (1,000 c.c.s.)

Dissolve the hypo in about ¾ of the total bulk of hot water. When this solution is still warm (not hot) dissolve the metabisulphite. Dissolve the chrome alum in the remaining ¼ of *warm* water, and when both solutions are cold add the chrome alum solution to the acidified hypo solution.

Hardening Baths

1.	Formalin (40%)	1 oz. (fl.) (50 c.c.s.)
	Water, to make	10 to 20 ozs. (500-1,000 c.c.s.)
2.	Alum	1 oz. (50 gms.)
	Water, to make	20 ozs. (1,000 c.c.s.)
3.	Chrome alum ...	1 oz. (50 gms.)
	Water, to make	20 ozs. (1 000 c.c.s.)

Whichever bath is used, allow it to act for 15 or 20 minutes.

For Extra Hardening

For use at temperatures up to 95°F. (35°C.), the following fixing bath may be used. It is best made up fresh each week:

Hypo	5 ozs. (250 gms.)
Sodium sulphite, dry	1 oz. (50 gms.)
Formalin	2½ ozs. (fl.) (125 c.c.s.)
Water, to make	20 ozs. (1,000 c.c.s.)

Dissolve first hypo, then sulphite, and finally add the formalin.

HYPO-ELIMINATORS

Wash the negative for one minute under the tap and transfer to a shallow dish containing very weak (clear pink) potassium permanganate solution.

Remove the negative as soon as the colour goes (which will be in a few seconds if much hypo is present), and keep on treating in the very weak permanganate baths until the colour is not quickly discharged.

The water itself will destroy the permanganate colour, but not as quickly as hypo does.

By this process a negative can be made ready for drying within three minutes of fixation.

Peroxide-Ammonia Eliminator

Kodak Research Laboratories recommend the use of hydrogen peroxide and ammonia, both volatile substances which combined oxidise the hypo to sodium sulphate which is inert and soluble. Thus any excess of eliminator evaporates on drying.

Water	16 ozs. (500 c.c.s.)
Hydrogen peroxide ... ... (3 per cent. solution)	4 ozs. (125 c.c.s.)
Ammonia (3 per cent. solution)	3¼ ozs. (100 c.c.s.)
Water, to make	32 ozs. (1,000 c.c.s.)

To make 3 per cent. ammonia dilute 1 part of 28 per cent. ammonia (U.S.A. strong) with 9 parts of water, or 1 part 0.880 ammonia with 9½ parts of water.

Directions for Use.—Wash prints for about 30 minutes at 65 to 70°F. in rapidly running water. For lower temperatures increase the washing time, which should be doubled for double-weight prints. After washing immerse each print in the eliminator solution for six minutes, and finally wash for about ten minutes before drying. About 50 10-in. by 8-in. prints or their equivalent may be treated by a gallon (5 litres) of solution.

For negatives, dilute 1 : 10. Higher concentrations should not be used owing to danger of blistering and softening the emulsion.

Slight yellowing of the whites of prints may be corrected by bathing for two minutes in a 1 per cent. solution of either sodium sulphite or acetic acid. Bathing in a 50 per cent. solution of de-natured alcohol solution for two minutes prevents over-riding of the squeegee roller when ferrotyping glossy prints.

Store away from the light in a loosely corked amber bottle.

RAPID DRYING

Rapid Drying of Prints.—Prints on "air-mail" or "document" papers may be dried rapidly by soaking them for one or two minutes in spirit, blotting off the excess and drying in the normal way. Prints on normal "single-weight" or heavier papers may be immersed for at least twenty seconds in undiluted spirit, pinned to a stick, and the spirit lighted at the bottom edge of the print. The stick should be waved to minimise any tendency for charring the edges of the prints to occur.

Formalin Method for Negatives.—Rinse from the hypo-bath, place in 1 : 50 formalin for ten minutes, wash by pouring nearly boiling water six times over the negative and dry by heat. To get rid of the relief which is produced by this process, the negative is rubbed with a piece of wash-leather moistened with alcohol.

Chrome Alum Method.—A method of rapid drying that is often useful with glass negatives consists of treating the negative, after washing, for three minutes in a 1 per cent. chrome alum solution, to which sufficient ammonia has been added to form a slight permanent precipitate. Give a brief rinse, blot off surface moisture, and dry over a Bunsen flame or in front of an electric fire. Drying under these conditions should take less than five minutes, but care must be taken not to crack the glass.

Drying Negatives by Alcohol.—Plates and films, also, may be dried, after washing, much more rapidly after immersion in alcohol. "Industrial" or "Surgical" spirit may be used, or any grade of denatured alcohol which does not show pronounced milkiness on dilution with water. Milkiness, if it does tend to occur, can be prevented by adding 1 per cent. of salicylic acid to the spirit. For use, the spirit should be diluted with three parts water to seven of spirit, and the plate or film immersed for not more than two minutes at not more than 70°F. Drying temperatures above 70°F. tend to cause milkiness. For economy of spirit, the water should be well drained from the material before immersion, and the spirit should not be left in open dishes for longer than can be helped; the two-bath method also helps—a first bath being used to remove most of the water, with a fresh bath to finish.

Diacetone Alcohol Method.—I. Davies and A. K. Soper of Kodak Research Laboratories have devised an elegant method of rapid drying by immersion in a mixture of a hydrophilic alcohol with a water-immiscible solvent. A mixture is made of 75 per cent. petroleum ether and 25 per cent. diacetone alcohol. The plate or film is immersed in this, whereupon the alcohol removes water from the surface of the swollen gelatin layer as fast as it diffuses from the interior, and the diacetone alcohol-water mixture, being immiscible with the petrol ether, streams away from the gelatin surface to form a separate heavier layer at the bottom of the vessel. This lower layer may be removed, say by siphoning, and the diacetone alcohol regenerated. Regeneration is thus carried out on relatively small quantities of diacetone alcohol-water, and the main bulk of the fluid remains essentially water-free. On immersion of the well-drained negative in the mixture, " liquid tears " immediately form over the negative and drip to the bottom of the container. Gentle agitation of the negative aids the detachment of the droplets. After one minute at room temperature, or when no further water appears to be exuded, the negative is removed and wiped with a soft cloth, after which it is, to all intents and purposes, dry.

The solvent mixture has a very slight softening action on film base, so that film material should not remain in the mixture for longer than is necessary to remove the water from the gelatin layer. Petroleum ether is, of course, highly inflammable, and this drying technique is therefore of practical value only when precautions appropriate to the use of such solvents can be fully observed.

Other solvent mixtures may behave in a similar manner, but those above have been found most effective. If carbon tetrachloride be substituted for petroleum ether, the aqueous layer floats to the surface and tends to re-wet the gelatin on withdrawal. On the other hand, the substitution of ethyl alcohol for diacetone alcohol gives a mixture very intolerant to moisture which promotes a rapid separation into two phases.

The chemicals are readily obtainable from any of the appropriate chemical supply houses.

RENDERING PRINTS TRANSLUCENT

Retouching Paper Negatives

To render prints about as translucent as paraffin wrapping paper, the following solution may be applied to the back with a broad camel-hair brush or cottonwool:

Tricresyl phosphate	50 parts
Petrol	49 parts
Acetone	1 part

The solution dries in a few hours and remains clear for years. As a *retouching fluid for paper negatives* it may be applied broadly as above or with a fine pen for producing hairlines. Parts worked on print darker than the remainder of the print.

HYPO ECONOMY AND SILVER RECOVERY

Although the majority of photographers are careful with developing solutions, they are far less particular about hypo solutions. And yet the quantity of hypo which is used and its present high price make careless use of hypo very expensive. Shortage of hypo does not greatly affect the small user who buys his hypo by the pound, but when hypo is bought by the hundredweight, it is more difficult to obtain.

There are two simple ways in which hypo can be saved—by preventing contamination by the developer and by exhausting it more completely. A rinse in water is not a very effective way of removing surplus developer before fixing, unless fast running water is used. It is true that a rinse does remove much of the developer from the surface of the emulsion, but the gelatin retains considerable quantities of developer alkali which will cause premature deterioration of the fixing bath. This can only be removed by using a weak acid rinse. There are several well-known types to choose from, but a cheap bath which is simple to prepare is a one to two per cent. solution of acetic acid. Kodak recommend a 1.7 per cent. solution, but the concentration is not very critical.

The two-bath fixing method is well-known but is not widely used. It is possible to use a fixing bath containing about three times the normal safe silver concentration and still not get stained results if the first bath, which removes the majority of silver halide, is followed by a second bath containing very little silver. In addition to the more economical use of hypo, recovery of the dissolved silver is much more efficient when the bath contains a high concentration of silver.

Another possibility of economising in hypo is to use a more dilute hypo solution, and compensate for the resultant increase in fixing time by adding ammonium sulphate to the solution. The fixing time will then be normal, but more silver can be tolerated relative to the quantity of hypo. It is the actual concentration of silver which is important rather than the percentage of hypo converted to the silver complex. In a negative fixer 400 gms. of hypo is replaced by 250 gms. of hypo and 100 gms. of ammonium sulphate and in a print fixer 170 gms. of hypo and 40 gms. of ammonium sulphate are used.

Testing fixing baths for exhaustion.—To test for exhaustion, take 10 c.c.s. of the bath and add 1.c.c. of a 4 per cent. solution of potassium iodide. If a yellow precipitate forms which will not redissolve the bath should be regarded as exhausted.

SILVER RECOVERY

Recovering silver from waste plates, films, and paper

Papers.—The simplest way of reducing waste photographic paper to a residue is to burn it, but unless the quantity is large it may be more convenient to send the paper as it is to such refiners as advertise their willingness to accept scrap material in this form.

Plates and Films.—Should be treated with hot caustic soda at about 2 per cent. concentration and 150°-200°F. Even at this low concentration care should of course be taken not to expose the skin too much to the hot alkali. This will decompose the gelatine and the silver will fall as a sludge. When a considerable amount has been collected and been allowed to settle, as much clear liquid as possible is decanted or siphoned off, and the quickest way of treating the wet sludge is to add sawdust in sufficient quantity to absorb the water and make a fairly dry mass.

RECOVERY FROM SPENT FIXING BATHS

There are two possible methods for recovering silver from a spent fixing bath—by adding a substance which will precipitate the silver as the metal or as an insoluble salt and discarding the liquor, or by removing the silver in such a way that the hypo can be re-used.

The simplest method is to add an excess of a precipitant to the old bath and then discard the liquor after the silver sludge has settled out. Unfortunately the most common agents used to precipitate the silver are both unpleasant, but other odourless precipitants are now being used effectively. In particular may be mentioned the odourless Silver Recovery Salts, particulars of which may be obtained from Johnsons of Hendon Ltd.

Sulphide precipitation.—The hypo must first be made alkaline by adding an ounce of crude caustic soda to each gallon of fixer. Two thirds of an ounce of fused sodium sulphide (or crude rock sulphide) dissolved in a few ounces of warm water are then added. The silver sulphide will settle out overnight, and then the liquor is run off, and the vessel recharged with further exhausted fixer. The process is repeated until the amount of silver sulphide sludge at the bottom of the vessel justifies the labour of removing it. It is advisable to dry the sludge as far as possible, to simplify despatching to the refiner. This may be effected with the aid of sawdust, as described above under " Plates and Films ".

Hydrosulphite precipitation.—The procedure is identical with the sulphide method, but one ounce per gallon of sodium hydrosulphite is used instead of the sodium sulphide. The silver is precipitated as finely divided metal. (N.B. Sodium hydrosulphite does not keep well, even when dry, and if it is exposed to a damp atmosphere it will rapidly become useless.)

Both the above procedures must be performed away from sensitive materials, and preferably in the open air, owing to the unpleasant gases produced.

Zinc precipitation.—Precipitation with zinc dust is simple and not unpleasant; but unless the solution can be stirred at frequent intervals, about three days must be allowed for complete precipitation. The procedure is very simple. The hypo is poured into the recovery crock and zinc dust sprinkled on the surface in the proportion of two thirds of an ounce of dust to a gallon of fixer. The zinc will sink to the bottom of the crock, and after three days the liquid may be drained off and replaced by a further charge of spent fixer. After three more days the sludge can be dried as above and sent to the refiner.

Iron precipitation.—In theory this can be done in the same way as the zinc dust, but as it is difficult to obtain rust-free iron dust, steel wool is used. This teased out to fill the recovery crock—half a pound of steel wool in a five-gallon vessel—and the vessel is then filled with fixer. After three days the liquid is drained off and replaced with further fixer, and so on until thirty gallons of fixer has been treated. Further steel wool may then be added, and the process continued until sufficient sludge has accumulated at the bottom of the vessel.

It is important that once the steel wool has been wet, it should not be exposed to the air unnecessarily or it will rust. Rusted iron or steel is quite useless.

SILVER RECOVERY WITH HYPO REJUVENATION

Some of the precipitation methods can, if carried out very carefully so that no excess precipitant is present, be used to recover the hypo also, but this is not recommended. The accuracy needed to produce a " reconditioned " fixing bath which is photographically innocuous is too great to make the process an economic one. There are, however, other methods for restoring fixing baths whilst at the same time recovering their silver content.

The simplest of these recovery processes—the " Argeco "—requires no external electrical supply, and is suitable even for the smallest user. The unit is in effect a voltaic cell which deposits silver at one electrode whilst the other is dissolved. This electrode needs replacement from time to time of course but its cost is certainly no more than the cost of the recovered hypo, and the recovered silver is on the credit side of the accounts. One unit will treat from four to ten gallons of spent hypo at a time depending on the silver concentration. The price of the complete unit is only thirty shillings and replacement cells are three and sixpence each.

The larger user is best served by mains-operated electrolytic systems. Broadly these comprise an electrode assembly to which is fed a low voltage continuous current of which the current value can be accurately controlled. When such an assembly is immersed in a fixing bath containing silver the silver becomes deposited on the negative electrode and can subsequently be removed by the refiners. The system functions continuously in the fixing bath, removing the silver as fast as the fixing process puts it in, and the electrodes may either be left immersed in the fixing tank itself, or, as in the larger installations, the fixing solution may be pumped out of the fixing tank, through the electrolytic unit, and back again into the tank, losing its silver—or most of it—in the process. In normal use these systems are highly efficient and give no trouble; but it is necessary to co-operate with the suppliers of the unit and to conform in every detail with their instructions.

The two electrolytic systems commercially available in this country are the Purhypo system and the Baker Electrolytic Hypo Unit; the addresses of the firms by whom they are operated are given below. In both cases the attention required by the user is negligible, and the saving effected by the recovery of the silver, in the case of larger users, is very great indeed.

DISPOSAL OF RESIDUES AND PURCHASE OF SUPPLIES

Baker Electrolytic Hypo Unit.—Baker Platinum Ltd., 52 High Holborn, W.C.1.

Purhypo Process.—D. Pennellier & Co. Ltd., 28 Hatton Garden, E.C.1.

Argeco Process.—Collingridge & Co. Ltd., Riverside Road, Watford, Herts.

Sludge refiners.—Baker Platinum Ltd., 52 High Holborn, W.C.1. Collingridge & Co. Ltd. (above address). Johnson & Sons, Smelting Works Ltd., Creek Works, Brimsdown, Middlesex.

Crude Sulphide.—Johnsons of Hendon.

CLEARING & STAIN REMOVING

Clearing Solutions

Acid Alum

Alum	½ oz. (50 gms.)
Citric Acid	¼ oz. (25 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

Wash well after fixing, and immerse the negative in the bath.

Chrome Alum

Chrome alum	¼ oz. (25 gms.)
Hydrochloric acid, or	¼ oz. (25 c.c.s.)
Citric acid	½ oz. (50 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

The bath containing citric acid is to be preferred.

Stain Removers

Alum-Iron

The following solution acts on the yellowish stain in a pyro-developed negative, and yields a negative of much quicker printing quality. The solution is slow in action, requiring about 20 minutes:

Alum	½ oz. (50 gms.)
Ferrous sulphate	1½ ozs. (150 gms.)
Citric acid	½ oz. (50 gms.)
or Sulphuric acid (conc.)	15 minims (3 c.c.s.)
Water, to make	10 ozs. (1,000 c.c.s.)

Thiocarbamide

For removing slight development stains from prints:

Thiocarbamide...	44 grs. (10 gms.)
Citric Acid	44 grs. (10 gms.)
Water	10 ozs. (1,000 c.c.s.)

First wash prints thoroughly to remove all hypo and immerse in the above bath for not longer than 5 minutes. If by this time the stain has not disappeared, it is due to some other cause than development. Prolonged immersion will reduce the image.

Sodium Hypochlorite

Bleaching powder (chlorinated lime) ...	1 oz. (30 gms.)
Sodium carbonate (cryst.)	1½ ozs. (45 gms.)

Shake up the bleaching powder with a solution of the carbonate in 6 ozs. or 180 c.c.s. of water. Filter and stir up the residue with about the same quantity of plain water and again filter. This liquid contains sodium hypochlorite, and when diluted with water to about 1 in 4 is Labarraque's solution. Eau de Javelle is obtained when potassium carbonate replaces the sodium salt.

Used with or without oxalic acid this solution, preferably diluted, will remove stains from negatives and prints although the image may begin to bleach out in a minute or so. Actually the bleached image may be re-developed, but often with reappearance of the stain. The solution has a softening effect on gelatine, and the operation must be carefully watched. Chlorinated soda solution will entirely remove ink stains and most vegetable dyes from prints, negatives and fabrics. Milton is a highly purified form of chlorinated soda and may be used for all the above purposes.

Bleach and Re-Develop

Heavy development stain is often entirely removed by the following Ilford formula:

Potassium permanganate	25 grs. (5.5 gms.)
Common salt	55 grs. (12.5 gms.)
Acetic acid (glacial) ...	4 drachms (50 c.c.s.)
Water, to make	10 ozs. (1,000 c.c.s.)

If the negative is one freshly made it should be hardened in a solution of 50 grs. of chrome alum in 10 ozs. of water. Bleach the negative for 10 minutes with continuous rocking, and clear in a 5 per cent. solution of potassium (or sodium) metabisulphite until white everywhere to the back of the film. The negative is then re-developed in a non-staining developer. With care this method may be used for prints, although a slight increase in density may occur.

Cleaning Dishes

A 5 per cent. solution of citric acid allowed to stand in dishes overnight will keep dishes clean. Very dirty dishes may be cleaned with a solution of water 80 ozs., potassium bichromate 7 ozs., to which is added very slowly concentrated sulphuric acid 8 ozs. This cleaner or citric acid is liable to attack inferior quality enamelled dishes. Porcelain tanks and dishes are best cleaned with a 50 per cent. solution of hydrochloric acid, which also can be used to clean bottles which are internally stained.

Hard rubber or vulcanite tanks and dishes should be scrubbed out and finally cleaned with a solution of sodium hypochlorite. Very hot or boiling water, however, should not be used.

INTENSIFIERS

The whole purpose of intensification is to increase contrast or gamma, and in this sense is limited to certain well-defined errors in exposure and development. Under-exposure, if accompanied by over-development, is an instance where intensification will exaggerate the faults of a " thin" negative resulting from these causes.

Softness, either through under-development or lack of contrast in the subject, is satisfactorily dealt with by the chromium or mercury intensifiers. Mercury has the advantage that with alkaline development it may be applied several times in succession if necessary, and a weak image strengthened to any desired extent.

If the plate is over-exposed, veiled and flat, giving a print of insufficient contrast, it should be reduced first with hypo and ferricyanide, and then, after washing, intensified as suggested in the preceding paragraph. When a negative is successively treated by any of these methods it is desirable, whenever practicable, to dry it after each operation.

Copper intensification, when followed by silver nitrate blackening, and lead intensification are generally reserved for line subjects in which great density accompanied by great clearness of the lines is required.

Uranium is perhaps the only intensifier which *may* improve a slightly under-exposed negative, since fine shadow detail is built up to a greater extent than the strong densities. This depends on partial intensification, which, however, is difficult to judge on account of the reddish-brown image. For 'ghost' negatives, uranium is admirable.

All negatives for intensification should be properly fixed in fresh hypo and thoroughly washed. Staining, however, is more liable to arise from imperfect fixing rather than from insufficient washing. Blistering and frilling of the gelatine may occur during treatment in acid intensifiers, and it is recommended that negatives should be hardened before beginning operations.

INTENSIFICATION WITH MERCURY

Mercuric Chloride

Mercuric chloride	120 grs. (27.5 gms.)
Water	10 ozs. (1,000 c.c.s.)

Dissolve the above in very hot water and use when cool. The new or used solution will keep indefinitely.

The negative should be bleached thoroughly until evenly white back and front, and afterwards washed for a few minutes, followed by two or three immersions in the following bath with rinsing between each:

Hydrochloric acid	30 minims (5 c.c.s.)
Water	12 ozs. (1,000 c.c.s.)

The acid bath prevents undesirable combination between the mercury and the gelatine, and aids the removal of the mercury residue. Blackening may be carried out by any of the following methods:

A. A dilute solution of ammonia, not exceeding 5 per cent. Negatives so blackened are not permanent, although the degree of intensification is high.

B. Any non-staining developer, such as metol-hydroquinone, amidol, etc., which gives a moderate degree of intensification sufficient for all ordinary purposes. The process can be repeated as many times as desired, valuable in the case of difficult subjects when sufficient strength cannot be obtained by other means. For photo-mechanical papers, however, re-development sometimes causes stain and scum, and the following is recommended:

C. Sodium sulphite (cryst.) 10 per cent. solution. This gives a good degree of intensification and is probably the safest method for both plates and films, and photo-mechanical (negative) papers. Repetition of the process, however, gives no increase in contrast, but a negative bleached in mercuric chloride and sulphite-blackened can be re-bleached and re-developed with an increase of density equal to that given by mercury and re-development.

MONCKHOVEN'S INTENSIFIER

A negative bleached in mercuric chloride is blackened in the following solution:

Potassium cyanide	10 grs. (23 gms.)
Silver nitrate	10 grs. (23 gms.)
Water	1 oz. (1,000 c.c.s.)

The silver and cyanide are separately dissolved and the former added to the latter until a permanent precipitate is formed. The actual quantity of silver nitrate to give such a precipitate depends on the quality of the cyanide salt. If pure cyanide is used, probably 50 per cent. more silver nitrate will be required than that stated in the above formula. Allow the mixture to stand 15 minutes and then filter. Bleach the negative until white back and front, wash and then blacken in above. This blackener is very useful for line and process negatives, but is not suitable for use with gaslight (silver chloride) lantern plates. Over-intensification may be reduced in a weak solution of hypo.

Monckhoven's blackener operates more efficiently if to the mercuric chloride of the bleacher is added an equal quantity of potassium bromide. Caution. The cyanides are deadly poisons and no acid should be allowed to come into contact with them.

Mercuric Iodide

Edwards's Formula Modified by W. B. Shaw

A first-class single-bath formula which intensifies visibly and can be stopped at any time:

Mercuric iodide	90 grs. (20 gms.)
Potassium iodide	90 grs. (20 gms.)
Hypo	90 grs. (20 gms.)
Water	10 ozs. (1,000 c.c.s.)

Dissolve the above in a very little water and make up to the full amount afterwards. Keeps well if stored in the dark.

After fixing, the negative should be rinsed for 5 minutes before intensifying, and then finally washed for 15 minutes. If required, intensification may be entirely removed in a 40 per cent. solution of hypo. For more gradual intensification and better control, dilute the solution with an equal volume of water.

Works quite well with photo-mechanical papers, but action is slower, and image seen from surface is a dirty green colour.

Negatives can be made permanent by treatment in a 1 per cent. solution of sodium sulphide until when viewed from the back the image has changed from grey to brown-black. Negatives so treated cannot be reduced in hypo solution.

Lumière Formula

Sodium sulphite (cryst.)	2 ozs. (200 gms.)
Mercuric iodide	45 grs. (10 gms.)
Water	10 ozs. (1,000 c.c.s.)

Dissolve the sulphite first. The negative needs rinsing for a few minutes only before intensification. Intensification need only be followed by a few minutes' washing, but negatives so treated are liable to yellow in time. A few minutes in any non-staining developer, however, renders the results quite permanent.

If mercuric iodide is not available, the following will serve the same purpose:

Mercuric chloride	50 grs. (11.5 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

Add 10 per cent. potassium iodide solution until the salmon-coloured precipitate of mercuric iodide is *just* re-dissolved, then to the clear solution add—

Sodium sulphite (cryst.) ...	2 ozs. (200 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

Chromium Intensifier

In earlier issues of the Almanac the chromium intensifier appeared as a concentrated two-solution formula capable of giving three degrees of intensification. The following simple one-solution formula, however, is more easily prepared and for this intensifier will give the maximum increase of contrast on most grades of plates and films.

Potassium dichromate	90 grs. (10 gms.)
Hydrochloric acid (pure conc.)	50 minims (5 c.c.s.)
Water ...	... 20 ozs. (1,000 c.c.s.)

Use without dilution, and proceed as follows: (1) Immerse the negative in the solution rocking the dish all the time until bleaching is complete (1½ to 3 minutes) as indicated by the changed character of the image which should have the same appearance on both sides of the negative. (2) Wash in running water for 5-10 minutes to reduce the stain. (3) Re-develop in any non-staining developer under white light, either artificial or diffused daylight. (4) Rinse re-developed negative. (5) Refix in acid bath, wash and dry.

Suitable developers are the B.J., M-Q formula, Kodak D.72, or Ilford ID.2 or ID.36, diluted 1 : 3 with water. Re-development should be continued until no further contrast can be obtained. The degree of intensification is controlled by the hydrochloric acid, a decrease of which will increase contrast. The acid concentration in the above formula, however, is the lowest that will ensure complete bleaching in a reasonable time.

N.B.—All negatives should be hardened before bleaching, particularly roll films, some makes of which reticulate otherwise.

Uranium Intensifier

A.	Uranium nitrate	100 grs. (23 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)
B.	Potassium ferricyanide	100 grs. (23 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)

For use, take A, 4 parts; B, 4 parts; acetic acid, 1 part. After intensification, wash in several changes of *still* water until the yellow stain is gone. A 2 per cent. solution of ammonium sulphocyanide will remove any yellow stain; weak ammonia or sodium carbonate removes the intensification and restores the negative to its original condition. If to be re-intensified first bathe in weak acetic acid.

Copper Intensifier

Gives great intensification and is best suited for line subjects.

A.	Copper sulphate	100 grs. (23 gms.)
	Water, to make	1 oz. (100 c.c.s.)
B.	Potassium bromide	100 grs. (23 gms.)
	Water, to make	1 oz. (100 c.c.s.)

A and B are separately made up with hot water, mixed, and allowed to cool. The negative is bleached in the mixture, and washed for a minute or two. It is then blackened in:

Silver nitrate	45 grs. (10 gms.)
Water (distilled), to make	1 oz. (100 c.c.s.)

For still greater density the negative is well washed from silver and an ordinary developer applied.

If too dense, after the silver, it can be placed in weak hypo solution (2 per cent.) or weak potassium cyanide (½ per cent.).

Copper Intensifier for Weak Negatives

An intensifier suitable for dealing with ghosts of images is the following, due to M. G. Zelger of the Pathe-Cinema Laboratories. The negative is bleached in a mixture of 2 parts of A and 1 part of B.

A.	Copper sulphate	45 grs. (10 gms.)
	Acetic acid, glacial	270 minims (56 c.c.s.)
	Water, to make	10 ozs. (1,000 c.c.s.)
B.	Potassium iodide	90 grs. (20 gms.)
	Ammonia (0.880)	1 oz. (100 c.c.s.)
	Water, to make	10 ozs. (1,000 c.c.s.)

Negative bleaches to a yellowish colour and is then washed for about 20 minutes in running water. It is then darkened with: Silver nitrate, 11 grs. (2.5 gms.); sodium acetate, 45 grs. (10 gms.); water, 10 ozs. (1,000 c.c.s.). To avoid stain, it is well to treat the negative with a solution of alum before using the darkening bath.

Lead Intensifier

The lead intensifier gives very great intensification, and is suited only for line subjects.

Lead nitrate	200 grs. (45 gms.)
Potassium ferricyanide	300 grs. (68 gms.)
Acetic acid	1½ drachms (19 c.c.s.)
Water, to make	10 ozs. (1,000 c.c.s.)

This stock solution will keep for a long time in the dark. The negative is bleached in it, washed once *very carefully* in 10 per cent. nitric acid—the acid makes the film very tender—then in water, and then darkened in:

A.	Sodium sulphide	½ oz. (50 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)

or in—

B.	Schlippe's salt	45 grs. (10 gms.)
	Ammonia (0.880)	3 drachms (37.5 c.c.s.)
	Water, to make	10 ozs. (1,000 c.c.s.)

or in—

C.	Potassium bichromate	1 oz. (100 gms.)
	Ammonia (0.880)	½ oz. (50 c.c.s.)
	Water, to make	10 ozs. (1,000 c.c.s.)

Any of the above darkening solutions gives great intensification.

Wellington's Silver Intensifier

A useful intensifier provided instructions are strictly carried out. It is proportional, and if the forebath is used correctly the original gradations are not materially altered. It also has the advantage that intensification may be stopped at any time during the process. As in the case of any process not familiar to the worker, it is advised that several tests be made with unimportant negatives so that the general effect and behaviour of the intensifier can be examined.

It is important that the negative should be fixed in a *fresh* hypo bath well washed and hardened in Formalin, 1 part; water, 10 parts, for 5 minutes. Thoroughly rinse the negative again and place it for *exactly one minute* in:

Potassium ferricyanide	10 grs. (2,3 gms.)
Potassium bromide	10 grs. (2.3 gms.)
Water, to make	10 ozs. (1,000 c.c.s)

The fore-bath plays no part in actual intensification, and is to prevent staining in the silver bath. It is, however, essential to success and must always be used. The stipulated time of immersion is also important, since any increase will start reduction and the final result will be a negative of altered gradation.

Wash well in running water and intensify as follows:

STOCK SOLUTION

A.	Silver nitrate	400 grs. (91.5 gms.)
	Water (distilled) to make	10 ozs. (1,000 c.c.s.)
B.	Ammonium thiocyanate	700 grs. (160 gms.)
	Hypo	700 grs. (160 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)

Take A, 1 oz. (100 c.c.s.), and add slowly to 1 oz. of B (100 c.c.s.), *stirring vigorously* with a glass rod. The mixture should then be clear. To this add 2 drachms (25 c.c.s.) of 10 per cent. pyro solution preserved with sodium sulphite. That is to say, the pyro must be dissolved in a 5 or 10 per cent. solution of sulphite. Then add 4 drachms (50 c.c.s.) of 10 per cent. ammonia solution.

Place the negative in a chemically clean dish, preferably of glass or porcelain, which has been cleaned out with hydrochloric acid and well washed, and pour the silver solution over it. Silver begins to deposit in a minute or two. When intensification has gone far enough, re-fix in an acid bath and wash well.

Over-exposed flat negatives are best over-intensified and then reduced in Farmer's reducer which will give greater contrast.

REDUCERS

(See also " Ink Drawings from Prints " (p. 324))

It should be recognised that all reducing processes, excepting the re-halogenisation method, are progressive, *i.e.* the operation can be stopped at any stage by judgment of the effect produced. At any future time reduction can be resumed, continuing exactly as if taken to a later stage at first.

Very dense negatives may be reduced to give shorter printing time Also, such reduction may be accompanied by an improvement in the gradation of the negatives according to the type of reducer employed.

Hard negatives, resulting usually from under-exposure and over-development, require a super-proportional or a proportional reducer of the persulphate or persulphate-permanganate class. The choice, of course, depends on the contrast of the negatives and the extent to which it is required to " soften " them without affecting shadow detail.

Dense negatives resulting from very great over-exposure are usually flat and without sufficient contrast. Consequently, their treatment should be such as will increase contrast during the process of reduction. For this purpose Farmer's or Belitski's reducers should be used, but with very great care, since these are subtractive or " cutting " reducers which attack delicate shadow detail first.

For consistent and trouble-free results it is advisable to adopt the sound general plan to make sure that all negatives and prints are entirely free from hypo, and have been sufficiently hardened to withstand the effect of decidedly acid baths.

Even when density is not excessive, flat negatives often benefit by slight reduction in Farmer's prior to intensification. This method is particularly useful as a means of clearing slight fog or veil in process negatives before intensification by mercury.

Howard Farmer's

This reducer produces a greater effect on the shadow detail or weak deposits than on the dense parts of a negative. For this reason it tends to increase rather than decrease contrast while reducing the actual density. (But see p. 309.)

Two solutions are required:

A.	Hypo, about	2½ ozs. (125 gms.)
	Water, to make	20 ozs. (1,000 c.c.s.)
B.	Potassium ferricyanide	1 oz. (100 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)

The working solution is prepared by adding 25 to 60 minims of B to each ounce of A (5 to 12 c.c.s. B to 100 c.c.s. A). The larger the quantity of B, the more rapid is the action; but beyond this there is practically no difference. The addition of B to A must only be made at the moment of using, as the mixed solution deteriorates very rapidly; it is quite useless in a few minutes. It should be lemon-yellow; if it acquires a blue-green tint in use, it should be thrown away and fresh solution substituted. It must never be used for two or more negatives in succession.

Haddon's Reducer

This reducer gives results similar to Farmer's but has the advantage that the solution is stable.

Potassium ferricyanide	22 grs. (5 gms.)
Ammonium thiocyanate	44 grs. (10 gms.)
Water to	10 ozs. (1 litre)

A slight white deposit may form on the film but may, after a brief rinse, be removed with hypo.

Belitski's

Potassium ferric oxalate ...	214 grs. (38 gms.)
Sodium sulphite (cryst.) ...	175 grs. (40 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

Dissolve and add:

Oxalic acid	50 to 65 grs. (12 to 15 gms.

and shake until the solution turns green. Then pour off from undissolved crystals and add:

Hypo	2½ ozs. (250 gms.)

This reducer is stainless and keeps well in the dark. Its action on the shadow detail of the negatives is similar to that of Farmer's. It varies somewhat with the strength of the solution.

Instead of the ferric oxalate, the following more easily obtainable chemicals can be used in the formula:

Ferric chloride (cryst.) ...	142 grs. (32.5 gms.)
Potassium oxalate	272 grs. (62.5 gms.)

Modified Belitski's

Ferric chloride...	109 grs. (25 gms.)
Potassium citrate	328 grs. (75 gms.)
Sodium sulphite (cryst.)	262 grs. (60 gms.)
Citric acid	87½ grs. (20 gms.)
Hypo	875 grs. (200 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

Dissolve the chemicals in the above order. This formula is recommended by Kodak Ltd. and is used without dilution unless slower action is desired, in which case dilute with an equal quantity of water. Treat negatives for 1 to 10 minutes, according to degree of reduction, and then wash thoroughly.

Persulphate. Super-proportional Reducer

Acts first on the heavy highlight densities, reducing these without affecting shadow detail. It thus " softens " a hard negative.

Ammonium persulphate	100 to 200 grs. (22 to 45 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

Provided the persulphate crystals are dry and not decomposed by absorbed moisture, the made-up solution will keep several weeks. Avoid storing large quantities of the solid persulphate; purchase instead small well-sealed bottles sufficient only for immediate use.

Reduction is carried out as follows: Immediately before beginning, add one drop of sulphuric acid to each 2 ozs. (60 c.c.s.) of persulphate solution. Immerse the negative, which must be free from hypo, and rock continuously during the process. The appearance of a cloudiness in the solution indicates that reduction has begun, and a slight change in the density of the negative should take place in about 20 to 30 seconds from this indication. Increase the time for greater reduction, but check carefully the progress. When the desired degree of reduction has been obtained, quickly immerse the negative in a 5 per cent. solution of crystallised sodium sulphite, which stops the action immediately; then wash thoroughly before drying. Failure of the solution to function may be due to its age or the condition of the solid persulphate before mixing, in which case wash the negative and begin again with a fresh sample of persulphate. When a very high degree of reduction is required, it may be necessary to change to a new bath during the process. A dry negative should be washed for at least half an hour in order that the gelatine can be evenly swelled, otherwise uneven reduction will take place.

Although we have always found that a solution acidified by sulphuric acid is entirely successful, 3 drops of ammonia or 2 drops of nitric acid to the quantity above mentioned is recommended from other sources. In all cases of reduction, but particularly in the use of persulphate, it is advisable to obtain some experience by trying out a few rejected negatives.

Permanganate Reducer

Semi-Proportional

This reducer is probably the most useful of the entire class; it is mistake proof and gives a reduced image revealing little if any trace of after treatment. The density of a wet negative is reduced evenly so that the effect lies in between that of a cutting and a proportional reducer, hence density is reduced without a change of gamma. A most efficient and easily remembered formula is:

Potassium permanganate	0.5 gms.
Sulphuric acid (conc. s.g. 1.84)	5.0 c.c.s.
Water	1,000 c.c.s.

Use undiluted, or for slower reduction with an equal part of water. If desired, the formula can be prepared from separate 10 per cent. solutions of permanganate and acid, and although the single solution keeps fairly well, it is preferably made up freshly before use. To reduce a dense negative simply immerse it in the above solution, rocking the dish all the time, and remove the negative when sufficient density has been taken away. Any brown stain remaining almost instantly disappears on immersion in a 2 per cent. solution of potassium metabisulphite or an acid fixing bath. Normal washing concludes the operation.

The ingredients in the above formula are in ratio to give the most reliable rate and quality of reduction. A reduction of the acid content will tend towards greater "cutting" action, but the accompanying greater degree of stain makes it difficult to check the actual amount of silver removed.

Proportionate Reducer

A mixed reducer of permanganate and persulphate acts proportionately on the densities of a negative, thus reducing contrast. The following formula is that worked out by Huse and Nietz, of the Eastman Research Laboratory.

A. Potassium permanganate... ...	1 gr. (0.25 gms.)
Sulphuric acid (10 per cent.) ...	65 minims (15 c.c.s.)
Water, to make	10 ozs. (1,000 c.c.s.)

The sulphuric acid is a 10 per cent. solution by volume of the 1.84 strong acid.

B. Ammonium persulphate	110 grs. (25 gms.)
Water, to make	10 oz. (1,000 c.c.s.)

These stock solutions keep well separately; they are mixed together at the time of use in the proportion of 1 volume of A to 3 volumes of B to form the working reducer. Reduction takes from 1 to 3 minutes.

After reduction, soak the negative for 5 minutes in a solution of 90 grs. (10 gms.) potassium metabisulphite in 20 ozs. (1,000 c.c.s.) of water, and then wash for a short time.

Iodine-Cyanide

A clean-acting (but intensely poisonous) reducer. Very suitable at various dilutions as a bleacher or reducer for bromide prints since it leaves no stain and does not affect the image colour of the print.

Iodine (10 per cent. sol.)	300 minims (60 c.c.s.)
Potassium cyanide (10 per cent. sol.)...	50 minims (10 c.c.s.)
Water, to make	10 ozs. (1,000 c.c.s.)

To make the 10 per cent. iodine solution mix about 150 grs. (35 gms.) potassium iodide with just enough water to dissolve it, add 44 grs. (10 gms.) iodine flakes which will dissolve rapidly on stirring; then add water to make 1 fluid ounce (100 c.c.s.).

Special Note.—Potassium cyanide varies considerably in cyanide (cyanogen) content. When the content is low, the above stated quantity of potassium cyanide may not decolourise the iodine solution. Regardless of the strength of the potassium cyanide used, gradually add this solution to the iodine until the colour just disperses; then add about 10 per cent. more cyanide solution. The reducer so prepared should be water white, and quickly loses its energy whether used or not.

Iodine-Thiocarbamide

R. B. Willcock's modification of T. H. Greenhall's formula

Iodine (10 per cent. sol.)	190 minims (10 c.c.s.)
Thiocarbamide (10 per cent. sol.) ...	380 minims (20 c.c.s.)
Water, to make	1 oz. (50 c.c.s.)

This non-poisonous formula may replace the iodine-cyanide reducer with entire success. The 10 per cent. iodine solution is identical with that used in the iodine-cyanide formula. Made up at the strength given above a clean 2-minute bleacher is obtained. Made up to 3 ozs. (150 c.c.s.) of water a slower acting solution results which is suitable for reducing the density of bromide prints. Instead of the iodine solution given above, Tincture of Iodine, Fortis, BP (strong Tincture of Iodine) may be used. This is a 10 per cent. solution of iodine in alcohol and is perfectly miscible with water and thiocarbamide solution.

Note.—As in the case of iodine-cyanide, this reducer when mixed rapidly loses its energy, although the individual solutions keep indefinitely.

Reducing Hard Negatives

Hard negatives may be safely reduced by re-halogenising and re-developing as follows:

Bleach the negative in a solution consisting of 1 part of 5 per cent. solution of potassium bichromate, 1 part of 10 per cent. solution of hydrochloric acid and 6 parts of water. Wash until the yellow stain disappears, then re-develop in a very weak non-staining developer such as M-Q or metol diluted to one-fourth or more of its normal strength. Rinse, fix and wash as usual.

The greater the dilution, the better will be the control over development speed, which should be slow enough to permit even action of the developer at an early stage for slight reduction. Obviously, if development is carried too far, the negative will be intensified, and as a precaution it is well worth while to practise on a few waste negatives as a guide to future work. As in all processes involving the use of acid solutions, negatives should be hardened previously.

Two-Solution Farmer's Reducer

For Reducing Contrast

In 1928, Crabtree and Muehler pointed out that potassium ferricyanide acted as a proportional reducer when used under easily applied conditions. It gives results similar to ammonium persulphate, but without the uncertainty associated with this erratic substance.

The two solutions are as follows:

A. Potassium ferricyanide ...	32 grs. (7.5 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)
B. Hypo ...	2 ozs. (200 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

Immerse the negative in solution A, rocking the dish all the time for ½ to 4 minutes according to the degree of reduction required. Then wash the negative for 10 minutes in running water, and fix for 5 minutes in solution B. This is followed by washing in the usual manner. The time of immersion in ferricyanide should be 30 seconds for slight, one minute for medium, and two minutes or more for considerable action. Unlike the combined ferricyanide-hypo reducer, little action is seen during treatment in the plain ferricyanide because the silver ferricyanide is not dissolved until the negative is transferred to the hypo bath. For this reason it is advisable to make tests with strips from an unwanted negative for times which increase from half a minute to 3 or 4 according to requirements.

The A solution particularly should always be made up accurately and used at the same temperature, otherwise any previous satisfactory result cannot be exactly repeated. Negatives which have been dried must be thoroughly soaked to ensure even action, and in all cases hypo must be removed as far as possible to prevent " cutting " action of the ferricyanide.

Local " Dry " Reducer for Prints

A.	Iodine	20 grs. (2.3 gms.)
	Methyl alcohol	1 oz. (50 c.c.s.)
B.	Thiocarbamide	40 grs. (4.6 gms.)
	Water, to make	1 oz. (50 c.c.s.)
C.	Methyl alcohol.	

Mix equal parts of A, B and C at time of use, and apply carefully to the dry print with a small brush or with cotton wool on a pointed stick. Stop the action by quickly wiping over with a cotton wool pad soaked in methyl alcohol. Repeat as often as may be necessary to secure the desired degree of reduction. Finally fix and wash. For slower action dilute the working solution with an equal quantity of methyl alcohol.

FERRIC SALTS AS NEGATIVE REDUCERS

For a brief general review see " Epitome of Progress " section of 1945 " Almanac ".

NEGATIVE VARNISHES

Cold Varnishes

Celluloid... ...	10 gms.
Amyl acetate ...	500 c.c.s.

To counteract the sickly odour add a little oil of lavender.

This may be flowed over or applied with a brush to the cold negative.

Zanzibar copal ...	30 gms.
Amber (fused) ...	5 gms.
Ether	300 c.c.s.
Acetone	200 c.c.s.
Chloroform ...	20 c.c.s.

Shellac Varnish

20 per cent. shellac solution ...	160 c.c.s.
Ammonia (0.880) ...	30 c.c.s.
Methylated spirit	320 c.c.s.

A mixture of Japanese gold size (1 part) and benzol (2 parts) forms a rather slow-drying though otherwise excellent cold varnish. The surface takes the pencil well.

Hot Varnishes

1. | | | |
|---|---|---|
| Sandarac | ... | 55 gms. |
| Seed lac | ... | 83 gms. |
| Castor oil | ... | 20 c.c.s. |
| Oil of lavender | | 10 c.c.s. |
| Alcohol | ... | 1,000 c.c.s. |

This varnish is somewhat dark in colour.

2. | | | |
|---|---|---|
| Seed lac | ... | 50 gms. |
| Sandarac | ... | 50 gms. |
| Oil of lavender | | 12.5 c.c.s. |
| Castor oil | ... | 25 c.c.s. |
| Alcohol | ... | 1,000 c.c.s. |

To prepare a good retouching surface, the negative, after varnishing, is dusted over with fine resin powder and rubbed up with the fingers.

3. | | | |
|---|---|---|
| White hard varnish | ... | 150 c.c.s. |
| rectified spirit | | 200 to 300 c.c.s. |

Methylated spirit should not be used. This will be found a good varnish if durability is not required, as it is easily rubbed up for retouching upon and easily cleaned off.

4. | | | |
|---|---|---|
| Best orange shellac | ... | 125 gms. |
| Oil of lavender | | 12.5 c.c.s. |
| Methylated alcohol | ... | 1,000 c.c.s. |

Instead of oil of lavender, oil of turpentine (pure) can be used.

Keep in a warm place until dissolved; then add a large teaspoonful of whiting or prepared chalk; shake, set aside to clear, and then decant. This is specially recommended for gelatine negatives.

5. | | | |
|---|---|---|
| Sandarac | ... | 115 gms. |
| Alcohol | ... | 800 c.c.s. |
| Oil of lavender | | 85 c.c.s. |

This is a good varnish for retouching upon, and a tooth is easily obtained by rubbing.

For Film Negatives

Water Varnish

Borax	...	...	35 gms.
Glycerine		...	30 c.c.s.
Shellac	...	...	70 gms.
Water	...	...	1,000 c.c.s.

Boil together for about half-an-hour, then add—

Methylated spirit 250 c.c.s.

and filter.

Dammar Varnish

Dammar	...	100 gms.
Benzol, 90 per cent.		1,000 c.c.s.

Filter, Benzol (*viz.*, benzene, not " benzoline ") must be of the 90 per cent. strength.

Ground-Glass Varnish

Sandarac...	...	10 gms.
Mastic ...	...	2.25 gms.
Ether (0.720)	...	100 c.c.s.

Dissolve the resins in the ether and afterwards add—

Benzol ... ... 25-75 c.c.s.

The proportion of the benzol added determines the nature of the matt obtained.

This varnish must be applied to the cold negative or the coating will not be matt.

Tinted Varnish

Malachite green, aurantia, or asphaltum is used for tinting the above matt varnish green, yellow, or brown respectively (for handwork on the back of a glass negative).

For the occasions, however, when a tinted matt varnish is required only in small quantity, *e.g.* for equalising the printing density of a negative, as convenient a means as any is to add a little ordinary iodine (flakes) to the ground-glass varnish made in accordance with the above formula.

BROMIDE, CHLORO-BROMIDE AND GASLIGHT PAPERS

Developing and Toning Formulæ

Bromide and Gaslight Papers. Although the relative insolubility of silver bromide and iodide in sodium sulphite solution makes it possible to use almost any M-Q developer for bromide papers, the same latitude does not obtain in the case of gaslight papers. Silver chloride in the latter is dissolved fairly rapidly and sulphite solvent stain will result if the sulphite concentration is too high in relation to that of the alkali. Such stain can only be prevented by using a developer containing a minimum of sulphite and a fairly high concentration of alkali, the object being, of course, to reduce the time in which the sulphite may exert its solvent power. For the same reason gaslight paper developers are used at greater strength than is usual for bromide papers. In both bromide and gaslight papers potassium bromide prevents fog and stain, and controls image colour. For gaslight papers, however, latitude in respect of colour control is very narrow, and in making up formulæ, the prescribed quantity of potassium bromide should be very carefully weighed, otherwise fog, stain or bad colour will result according as the error is above or below the exact quantity.

Chloro-Bromide Papers. As the name implies, these contain both silver chloride and bromide. The ratio of the two halides determines the printing speed, range of image colour and the sensitivity to colour changes of the emulsion in developers of different composition. Usually slower grades, containing a predominance of silver chloride, are the most amenable to colour control, although many rapid varieties are exceptionally versatile when used with specially prepared formulæ. Colour control is effected mainly by variation of the bromide content, dilution, and in some cases temperature, and for maximum warmth, approaching red, special formulæ are required. These generally contain chlorquinol or glycin alone or individually combined with hydroquinone, and their suitability for colour control is significantly associated with acute sensitivity to bromide. Many slow chloro-bromide papers will give a black or blue-black colour with a gaslight paper developer, and in most cases a normal bromide paper developer provides a slight pleasing warmth which increases with added bromide and dilution. Modifying the developer by highly restraining it and/or by extreme dilution to produce warmth involves some increase of exposure which tends to decrease contrast. In consequence, a print of good gradation and rich colour is only possible from a negative of strong contrast. Even with a negative of this type, undue over-exposure and short development in a highly restrained and diluted bath will produce flatness and poor colour. It should be appreciated therefore, that the full versatility of chloro-bromide paper and the certainty with which the desired colour associated with good quality may be obtained and duplicated at will depend on systematic methods and continued practice.

DEVELOPERS

Amidol

This developer will not keep made up for more than two days.

Sodium sulphite (cryst.)	240 grs. (55 gms.)
Potassium bromide	6 grs. (1.4 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)
When dissolved, add—	
Amidol	24 grs. (5.5 gms.)

For stronger prints reduce the water to 8 ozs. (800 c.c.s.).

For gaslight papers reduce the bromide to 1.5 grs. (0.35 gm.). This reduced bromide also gives a colder black on bromide prints, but the full quantity *must be used for prints intended for toning.*

Metol-Hydroquinone

One-solution

A one-solution M-Q developer suitable for bromide papers is that given under the heading " Negative Developers " on p. 290 and is used at the same working strength as for negatives. The same formula gives good colour on gaslight papers if the bromide is reduced to 1.5 grs. (0.35 gm.). See note under Amidol.

Two-solution

No. 1

Sodium sulphite (cryst.)	480 grs. (110 gms.)
Potassium (or sodium) metabisulphite	80 grs. (18.3 gms.)
Metol	20 grs. (4.6 gms.)
Hydroquinone	60 grs. (14 gms.)
Potassium bromide	20 grs. (4.6 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

No. 2

Sodium carbonate (cryst.)	640 grs. (147 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

For bromide papers take No. 1, 1 part; No. 2, 1 part; water, 1 or 2 parts.

For gaslight papers reduce the bromide to 5 grs. (1.15 gm.) and for vigorous grades take No. 1, 1 part; No. 2, 1 part, without added water. For normal grades add 1 part of water. Any tendency to staining due to stale paper may sometimes be prevented by the addition of one or two drops of 10 per cent. bromide and a 10 to 20 per cent. increase of the No. 2 solution.

Metol-Hydroquinone

For Long-keeping

The following formula for bromide and gaslight papers was originally included in this section as having a storage life of about 18 months. Evidence of much longer keeping is given, however, by Charles Macnamara, who states that after 10 years' storage the developer remains as good as new. Our contributor has used this formula for many years with complete satisfaction, and we give it here again as particularly suitable for those whose work is of an intermittent nature:

A.	Metol	32 grs. (3.6 gms.)
	Hydroquinone	120 grs. (13.7 gms.)
	Alcohol	2 ozs. (100 c.c.s.)

Mix and shake well, but not all will dissolve.

B.	Sodium sulphite (cryst.)	3 ozs. (150 gms.)
	Sodium carbonate (cryst.) ...	3 ozs. (150 gms.)
	Potassium bromide	8 grs. (1 gm.)
	Water, about	10 ozs. (500 c.c.s.)

Heat water to about 130°F. and add the sodium sulphite. Continue heating to nearly boiling point, meantime adding the sodium carbonate. When all is dissolved, pour hot solution B into solution A and add the potassium bromide. Then add water to make solution up to 20 ozs. (1,000 c.c.s.).

Store in well-corked bottles filled to the neck.

For bromide papers, take 1 part stock solution to 3 parts water. For gaslight papers, 1 part stock solution to 1 part water. This developer gives excellent results with practically all makes of bromide and gaslight papers.

Chloro-Bromide Developers

The following formulæ will give tones ranging from warm black via brown-black and sepia to red, according to the duration of exposure and degree of dilution. Where chlorquinol is specified, either alone or in conjunction with hydroquinone, glycin may be substituted provided the sodium carbonate is increased by 50 to 60 per cent. This, however, does not apply to formulæ containing metol:

	Kodak D-156	Kodak D-166	Kodak D-163	Gevaert G-261	B.J. formula	
Metol	1.7	1.15	2.2	—	—	gms.
Sodium sulphite cryst.	44	50	150	80	50	,,
Hydroquinone	6.8	8.5	17	6	—	,,
Chlorquinol	—	—	—	—	7	,,
Kodurol or Glycin	—	—	—	6	—	,,
Sodium carbonate cryst. ...	44	68	175	80	50	,,
Potassium bromide	6.3	12.5	2.8	2	1.8	,,
Water	1,000	1,000	1,000	1,000	1,000	c.c.s.

KODAK D-156.—Gives medium warmth of image on "Bromesko" paper when used diluted with 1 part of water. Develop for 1½-2 minutes at 68° F.

KODAK D-166.—For maximum warmth of tone on "Kovita" and "Bromesko" papers (short of red); suitable also for warm-tone lantern plates. Use 1 part developer to 3 parts water. Develop for 2-3 minutes at 68°F. With this development time the correct exposure will give a first appearance of image of about 50 seconds. Warmth of tone may be varied by increasing or decreasing development time with corresponding decrease or increase of exposure.

KODAK D-163.—A general purpose paper developer, recommended for warm-black tones on "Bromesko" and "Kovita" papers. Use 1 part developer to 3 parts water and develop for 1½ minutes at 68°F. (Kovita and Bromesko glossy) or 1½-2 minutes at 68°F. (Bromesko).

GEVAERT G-261.—For brown to red tones on Vittex paper. The exposure should remain constant for all dilutions. The tone will be more red and the development time should be lengthened the more the developer is diluted. Image colour is affected by change of temperature.

B.J. FORMULA.—For brown-black tones use undiluted. For sepia and red-brown tones increase exposure and dilute the developer up to 1 in 6 or more with added bromide. Normal time of development 2 to 3 minutes at 65°F.

Special Note

Negatives lacking in vigour do not produce well-graded prints by usual methods specified to produce pronounced warmth of tone. For this reason colder tones must be obtained by giving minimum exposure and full development in a concentrated solution. For maximum warmth from flat negatives with minimum loss of contrast, normal exposure as for concentrated development should be given, followed by full-time development in a plain glycin or chlorquinol developer diluted to about 1 in 3 or 4.

Toning of chloro-bromide prints is satisfactory only when prints have not lost contrast by over-exposure and dilute development. This implies normal exposure and development times in a standard M-Q developer or a formula such as D-156 or ID-23. An exception is made, however, in the case of extra-contrasty negatives from which soft prints may be made by slight over-exposure and dilute development prior to toning.

SELENIUM TONING

For Purple-reddish-brown Tone

Selenium powder	3.4 grams
Sodium sulphide	52 grams
Water	500 c.c.s.

Warm the solution to make sure the selenium is dissolved, then dilute well with water for use according to tone desired. A suggested dilution is 1 part above stock solution to 10 parts water.

For Ilford Plastika.—One to two minutes gives good colour. Any time above 2 minutes does not alter tone but materially increases yellow-brown stain.

For Bromide Paper.—Print should first be bleached and then selenium toned for 2-3 minutes.

N.B.—Discard selenium working solution after use.

SULPHIDE TONING

Probably the most reliable method of producing warm-brown tones on bromide prints is by the sulphide process by which prints are first ferricyanide and bromide bleached, washed and finally darkened or toned in sodium sulphide solution. The necessary solutions are:

STOCK BLEACHING SOLUTION

Potassium bromide	½ oz. (50 gms.)
Potassium ferricyanide	1 oz. (100 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

This solution will keep indefinitely if protected from strong light.

For use: take 1 part of the above to 9 parts water.

An alternative bleaching formula originated by T. H. Greenhall.

A.	Hydrochloric acid, pure	3 ozs. (150 c.c.s.)
	Water, to make	20 ozs. (1,000 c.c.s.)
B.	Potassium permanganate... ...	40 grs. (4.5 gms.)
	Water, to make	20 ozs. (1,000 c.c.s.)

Both A and B keep indefinitely stoppered.

For use, mix in the order given: Water, 6 ozs.; A, 1 oz.; B, 1 oz.

Either bromide or warm tone papers may be bleached in the above solution which in most cases prevents any tendency to yellowness, particularly in warm tone papers. Complete bleaching takes place in about one minute or less, but in case of sluggish bleaching, discard the solution and start again with fresh. Prints from the fixing bath require only a rinse before bleaching and only 2 or 3 minutes wash before sulphiding or toning in the thiocarbamide toner.

The process has the advantage that a partial bleach, say 5-15 seconds followed by toning produces a rich, dark sepia tone. Provided the volume of the bleaching solution is sufficient, a batch of prints may be treated, but the solution must be discarded after use.

Stock Sulphide Solution

20 per cent.

Sodium sulphide, pure	4 ozs. (200 gms.)
Water, to make	20 ozs. (1,000 c.c.s.)

For use, take 3 parts of stock sulphide solution to 20 parts of water

Prints for toning must be well washed and hypo free before bleaching, and in hot weather or where the water supply has a softening action on prints a fixing-hardening bath should be used. (See "Fixing".) Proceed as follows:

(1) Bleach the prints in ferricyanide-bromide solution for 2 or 3 minutes—*i.e.* until the image becomes faint brown in colour. Dark or black patches that will not bleach out indicate that the bleacher (which may be used repeatedly) is becoming exhausted.

(2) Rinse the prints in clean water for ½ to 1 minute. Longer washing does no good and may impair the tone.

(3) Transfer the prints to the sulphide bath, where they should darken in about 30 to 60 seconds.

(4) Finally wash prints for half-an-hour in running water. Sulphide toned prints are thoroughly permanent.

The above method may be used for both transparencies and gaslight prints, although the latter may more easily give unpleasant tones due to errors in exposure and development.

Faults and Defects

Blue stains in spots or patches are due to iron impurities in alum or rust in tap water. Use hypo-metabisulphite fixing bath followed by formalin hardener, or see that the alum is pure and fit flannel filter to tap. Blue spots may be removed after the print is thoroughly dry by applying dilute hydrochloric acid or sodium hypochlorite solution, followed by washing.

Yellow tones. These result from over-exposure and short development, weak or exhausted sulphide solution, and in some cases from old or exhausted developer.

Loss of detail. Due to residual hypo causing the ferricyanide to reduce permanently medium and higher tones.

Veiled whites. Mostly due to fog caused by faulty safelight or by forced development in developer deficient in bromide. Occasionally caused by a chrome alum fixing bath which is too strong or stale.

Streaks and untoned patches. These can be prevented by rubbing the print over as soon as it is put in the sulphide bath, and continuing to rub it fairly hard. It may be necessary to so treat the print throughout immersion in sulphide, in which case it is well to make sure that the print has been sufficiently hardened. This method gives good results with prints which have been lying untoned for some time.

Bad colour and insufficient depth. These faults are due largely to the same causes as those referred to under Yellow Tones above. Although no amount of after-treatment can convert a poorly-toned print into a good one, some improvement may result from either re-bleaching and re-toning, or partly bleaching and re-development. By the first method, the print is bleached in the copper bleacher given under the heading " Ink Drawings from Prints " and re-toned. By the second method, the same bleacher is used diluted with two or three parts of water and the print is *partly* bleached and re-developed in any ordinary bromide paper developer. Greenhall's permanganate-hydrochloric acid bleacher given under " Sulphide Toning " may be also used. The longer the bleacher is allowed to act, the colder and darker will be the final tone after re-development. Actually, a print so treated has not a pure tone since the deepest shadows will tend more towards black than the lighter tones.

Treat the prints in the following bleacher:

Copper bromide	260 grs. (27 gms.)
Sodium bromide	5 ozs. (222 gms.)
Water	20 ozs. (1,000 c.c.s.)

Bleach the print in the darkroom and re-develop in daylight in any non-staining developer, then re-tone.

IMPORTANT NOTE.—Do not use the sulphide bath near any unexposed sensitive materials, and discard solution down the drain after use.

THIOCARBAMIDE TONING BATH

Thiocarbamide may replace sodium sulphide which is usually used to tone bromide and gaslight prints following the ferricyanide-bromide bleach. The toning solution is made as follows:

A.	Thiocarbamide	1 oz. (100 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)
B.	Sodium hydroxide	1 oz. (100 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)

For use take A, 1 part; B, 2 parts; water, 32 parts.

Bleach the prints in the ferricyanide-bromide solution exactly as prescribed for sulphide toning, rinse and then tone in the working thiocarbamide working solution just given. Any tendency of the caustic solution to soften the gelatine may be lessened by using one part of the B solution instead of two.

The speed of toning and the colour of the final image is controlled by the alkalinity of the bath. With insufficient alkali toning is slower and the colour tends to become yellow, hence for flat, toneless subjects slightly increase the amount of B solution. Some papers react better to this toner if they are bleached in the permanganate-hydrochloric acid formula.

Thiocarbamide gives rich sepia tones on both bromide and gaslight papers, and, moreover, is free from the disagreeable smell associated with sodium sulphide.

Hypo-Alum Toning

This method of toning bromide and gaslight prints is particularly suitable for chloro-bromide papers, to which it gives a much better sepia than is obtained by the sulphide method. There is, however, some doubt as to whether hypo-alum is as permanent as the two-bath sulphide method, a contributory cause being failure to wash the prints thoroughly after fixing. This is particularly so when an exhausted fixing bath is used, which if followed by insufficient washing will cause veiling and staining of the whites. Prints should be fixed in a hardening-fixing bath or hardened separately and preferably dried before toning. They are then directly toned in the hypo-alum mixture made as follows:

Hypo	1 lb. (400 gms.)
Hot water	80 ozs. (2,000 c.c.s.)

Dissolve and then add:

Alum	3½ ozs. (87 gms.)

Stir well, boil for 2 or 3 minutes, cool to about 150°F. (65°C.) and then add the Silver Ripener, made as below.

Stir well again and add:

Potassium iodide	40 grs. (2.3 gms.)

The whole mixture is thoroughly well stirred.

Silver Ripener

Silver nitrate	20 grs. (1.3 gms.)
Water	1 oz. (30 c.c.s.)

To this add, drop by drop, strong (.880) ammonia until the precipitate first formed is just re-dissolved. Stir vigorously while adding the ammonia.

The toning bath can be used repeatedly, keeping up the bulk by occasional addition of fresh solution, but the replenished bath should not be filtered. The best results are obtained by keeping the bath as hot as the emulsion will stand, say, 100 to 120°F. (38 to 50°C.). At this temperature the prints will tone in from 20 to 30 minutes. The bath can be used cold, in which case toning will take about 24 hours.

Allow plenty of solution for batch toning, and pass the prints in one by one, at once making sure that they do not stick together. After toning, the prints should be hardened in a plain alum bath, but allow them to cool before hardening, otherwise blisters will appear, due to sudden change of temperature. Finally swab off the sediment from the surface of the prints and wash thoroughly.

Colder tones may be obtained by reducing the quantity of potassium iodide or omitting it entirely.

Liver of Sulphur Toning

Liver of sulphur	15 grs. (1.7 gms.)
Water	20 ozs. (1,000 c.c.s.)

This bath is suitable for bromide and gaslight papers and tones in about 30 minutes. The results are similar to those obtained by hypo-alum. The liver of sulphur must be perfectly fresh, and must be mixed and used well away from unexposed sensitive materials.

Silver-Mercury Sulphide

(H. W. Bennett's process)

This process produces brown-black to warm brown tones with certainty, provided the print has been fully developed.

The following stock solutions are required:

A.	Potassium ferricyanide	2 ozs. (100 gms.)
	Potassium bromide	1 oz. (50 gms.)
	Water, to make	20 ozs. (1,000 c.c.s.)
B.	Mercuric chloride	½ oz. (25 gms.)
	Water, to make	20 ozs. (1,000 c.c.s.)

To prepare the bleaching bath, take the various quantities of A and B specified below for each ounce of working solution, according to the colour desired.

A. 60 minims	Rich warm brown.
A. 60 minims ... ... B. 30 minims	Cool brown.
A. 40 minims ... ... B. 40 minims	Very deep brown.
A. 40 minims ... ... B. 80 minims	Brown-black.

Intermediate proportions will yield corresponding tones.

Whenever solution B is used in compounding the bleaching bath, a 1 per cent. (pure) hydrochloric acid bath must be given, and then a few minutes' washing before sulphiding the prints.

When the bleaching bath contains solution B, intensification takes place, according to the proportion of B used. Allowance must be made for this in printing, by decreasing the exposure and not by shortening development. When the full quantity of B solution is used, three-fourths of the normal exposure is correct, the print being developed normally.

Nitro-Sulphide Toning

(W. B. Shaw's Process)

This process is based on the fact that sulphide solutions with a suitable oxidising agent tone directly, thus obviating the necessity for an intermediate bleaching bath.

The nitro-sulphide process will yield more pleasing results on "gaslight" papers than the bleach and sulphide method, the colours resembling those obtained by hypo-alum toning.

Stock solutions:

Solution A

A saturated solution of barium sulphide. To prepare this ¼ oz. (12.5 gms.) of barium sulphide is shaken up with 20 ozs. (1 litre) of warm water and the undissolved portion allowed to settle. The clear liquid is poured off for use. The bottle must be kept tightly closed.

Solution B

A 10 per cent. solution of sodium meta-nitro-benzene sulphonate.

For use take A, 4 ozs. (100 c.c.s.), and B, 2 drams (6 c.c.s.).

The best results are obtained by giving prints a generous exposure and developing with M-Q. The final tones vary considerably with different brands of paper, ranging from purple to warm brown. As the progress of toning is under direct observation, intermediate colours can be secured with ease.

With slow bromide and chlorobromide papers toning may be too rapid for convenient control. In such cases the solution should be largely diluted with water.

If toning is carried to completion, fast contrasty papers usually give cold tones and slow normal papers warm ones.

The temperature of the toning bath should not be below 60°F. (16°C.).

Prints for this process need not be completely washed after fixing, but it is just as well to wash for a few minutes before toning.

Copper Toning

A.	Copper sulphate	60 grs. (7 gms.)
	Potassium citrate (neutral salt)	240 grs. (28 gms.)
	Water to	20 ozs. (1,000 c.c.s.)
B.	Potassium ferricyanide	50 grs. (6 gms.)
	Potassium citrate	240 grs. (28 gms.)
	Water to	20 ozs. (1,000 c.c.s.)

Use equal parts of each. If prints are pinkish in the highlights use more citrate in the A or B solution.

The copper toning process gives a range of tones from warm brown to light red, according to the time of action of the solution. Toned prints last fairly well but are inferior in permanence to those made by the sulphide-toning method. The toning has scarcely any perceptible effect on the depth of prints.

In this mixture which must be used soon after making, prints gradually tone and pass through the stages of purplish black and brown to a decided red. Prints should be well washed from hypo before toning.

Uranium Toning

This old method yields brown to reddish tones. It intensifies the prints, but the results may prove impermanent.

A.	Uranium nitrate	90 grs. (10 gms.)
	Water ...	20 ozs. (1,000 c.c.s.)
B.	Potassium ferri-cyanide	90 grs. (10 gms.)
	Water	20 ozs. (1,000 c.c.s.)

Use equal parts of A and B and add 20 minims of glacial acetic acid to each ounce of mixture (40 c.c.s. per litre). The prints must be free from hypo. After toning wash in several changes of *still* water till the high-lights are clear. Washing in running water will remove the toning in patches. Citric acid (10 grs. per oz.—23 gms. per litre) or oxalic acid (5 grs. per oz.—11 gms. per litre) instead of acetic is an aid to pure whites.

As a means of rendering uranium-toned prints permanent it is recommended to fix the toned prints for five minutes in hypo, ½ oz. (25 gms.); potassium metabisulphite, 70 grs. (8 gms.); water, 20 ozs. (1,000 c.c.s.).

Blue Tones

A.	Potassium ferricyanide	15 grs. (1.7 gms.)
	Sulphuric acid, conc.	30 minims (3 c.c.s.)
	Water	20 ozs. (1,000 c.c.s.)
B.	Ferric ammonium citrate	15 grs. (1.7 gms.)
	Sulphuric acid, conc.	30 minims (3 c.c.s.)
	Water	20 ozs. (1,000 c.c.s.)

Mix equal parts of A and B at time of use. Prints should be light, as the toning also intensifies. When toned, wash to remove all yellow colour.

Green Tones

A.	Potassium ferricyanide	180 grs. (2 gms.)
	Water, distilled	20 ozs. (100 c.c.s.)
B.	Vanadium chloride (stock soln.)	3¼ drs. (3 c.c.s.)
	Ferric ammonium citrate (*green*)	45 grs. (1 gm.)
	Sodium citrate neutral	2½ ozs. (25 gms.)
	Ammonium chloride	90 grs. (2 gms.)
	Hydrochloric acid	1½ ozs. (14 c.c.s.)
	Water, distilled	10 ozs. (100 c.c.s.)

The hydrochloric acid is the "pure strong' 'of 1.16 sp. gr.

The stock vanadium solution is made by mixing 1 oz. of vanadium chloride, as purchased (Merck's syrupy), with 5 drams (18 c.c.s.) of strong hydrochloric acid and then adding distilled water to make 2 ozs. 90 minims (62 c.c.s.) in all.

In making up the B solution first add the hydrochloric acid to the vanadium solution. Then dissolve the ferric citrate, soda citrate, and ammonium chloride in 100 c.c.s. water and mix the two. Solution should be dull mauve blue; not green—until mixed with A.

Both A and B solutions will keep for months at least.

To mix the toning solution take 1 part A with 4 parts water, and separately, 1 part B with 4 parts water. The two weak solutions when mixed together form the toner.

Prints tone in from 4 to 8 minutes. Rock constantly, then wash in 5 changes of water, each of 2 minutes; give a bath of hydrochloric acid (1 part in 50 parts water) for 2 minutes, and finally wash for 15 minutes in 7 or 8 changes of water.

Prints should be of the ordinary depth. The green tone is permanent.

Red Tones

A.	Nickel nitrate...	220 grs. (5 gms.)
	Potassium citrate	660 grs. (15 gms.)
	Water	10 ozs. (100 c.c.s.)
B.	Potassium ferricyanide	90 grs. (2 gms.)
	Water ...	5 ozs. (50 c.c.s.)
C.	Dimethyl-glyoxime (saturated soln. in methyl alcohol)	½ oz. (5 c.c.s.)
	Sodium hydroxide (0.4> solution)	½ oz. (5 c.c.s.)
	Water ...	5 ozs. (50 c.c.s.)

Bleach in a freshly prepared mixture of solutions A and B which has been acidified with a little dilute nitric acid. Place the print for 2 to 3 minutes in solution C to which has been added 3 to 4 drops of ammonia per ounce of solution; finally fix in plain hypo. The image so produced is red.

If, after fixing, the red toned print is treated with a slightly acidified solution of ferric sulphate and potassium bromide, violet tones are obtained. Red-brown tones are obtained on treating the red toned print with sodium sulphide; in this case it is advisable to add 0.5 gm. potassium bromide to solution A.

Gold Toning

For improving the colour of greenish or rusty black prints, and for bluish tones.

Ammonium sulphocyanide	130 grs. (15 gms.)
Chloride of gold	9 grs. (1 gm.)
Boiling water ...	20 ozs. (1,000 c.c.s.)

Use as soon as cool. Place the wet print face upwards on a sheet of glass, squeegee into contact, blot off superfluous moisture, and paint the above bath on with a broad flat brush; when the desired tone is reached wash well and dry.

GLAZING PRINTS

Most modern printing papers of good quality are coated with emulsions which are hardened during manufacture, and for this reason prints rarely require any special treatment to facilitate their removal from glass plates or metal sheets. As a precaution, however, all prints for glazing should be fixed in a hardening-fixing bath, or if a non-hardening acid bath has been used, they should be hardened in a separate bath. The finest gloss is obtained on prints which have not been hardened during processing, and are allowed to strip off by drying at a normal temperature. Failure of prints in this condition to strip off without assistance, or their proneness to sticking, is often attributed to softening of the gelatine. This is not the case with papers of high repute, the cause being mainly due to faulty methods and/or the use of an unsuitable glazing solution or none at all.

A number of first-class glazing solutions can be bought ready made or one may be prepared from:

Oxgall, prepared ...	1 oz. (12 c.c.s.)
Water	80 to 160 ozs. (1,000 to 2,000 c.c.s.)

The prints are soaked in this solution for a minute or two and laid on the glasses, ferrotypes or drum surface without intermediate washing.

Those who do not object to the mess (and smell) may prepare oxgall from gall bladders obtained from a butcher or slaughterhouse. The fluid from the bladder is mixed with formalin in the proportion of about 2 ozs. of formalin per gallon of gall (12.5 c.c.s. per litre). The mixture is filtered through several thicknesses of butter muslin, after which it is bottled and will keep for a long time.

A polishing medium to be applied to glass, ferrotype or chromium plates before squeegeeing the prints is:

Beeswax	20 grs. (45 gms.)
Turpentine	1 oz. (1,000 c.c.s.)
or	
Spermaceti wax	20 grs. (45 gms.)
Benzol	1 oz. (1,000 c.c.s.)

a few drops of which are rubbed on with a piece of flannel and the glass afterwards polished with silk rag or chamois leather.

When heat is used to accelerate stripping, either on loose flat plates or rotary drums, great care is necessary to produce a good gloss without the prints sticking. Precautions to be taken are: Wash the glazing surface frequently with soap and hot water, followed by thorough rinsing and drying; finally polish off with petrol, benzine or the wax polish given above sparingly applied with clean material. Glass plates may be treated the same way, followed by a final polish with prepared chalk or whiting.

Prints should be swabbed over with cotton wool or viscose sponge after washing to remove grit, and then placed in grit-free (filtered) water before glazing. The smallest particle of grit will prevent adhesion of the print in its vicinity and will show in the glazed print as a semi-matt spot similar to an air bubble. Oyster shell markings are caused by uneven drying by heat. This is prevented by hanging the plates in an air-circulated drying cupboard or at least making sure that the plates are not submitted to sudden changes of temperature. Very great heat will ruin the surface of ferrotypes by causing "matting" which is more likely to occur when prints are squeegeed from a methylated spirit bath.

Persistent sticking in spite of all precautions is usually cured by drying the prints first and then wetting them thoroughly again before glazing.

Enamel Collodion

(For Glazing both Gelatine and Collodion Prints.)

Glass plates cleaned with French chalk are coated with the following solution:

Soluble gun-cotton	125 grs. (14 gms.)
Alcohol	10 ozs. (500 c.c.s.)
Sulphuric ether	10 ozs. (500 c.c.s.)

and, as soon as coating has set, slipped under prints which are waiting face down in water. Prints are withdrawn and squeegeed. When they are half-dry, a stout backing paper is pasted on with good thick photo-mountant, and the prints then allowed to dry. The object of the backing paper is to prevent penetration of moisture when the prints are mounted. They are finally stripped off.

Glazing Matt Prints

It is frequently desired to glaze a matt print, either for appearance, for protection against atmospheric contamination, for brightening up a print for copying or blockmaking or to mask hand or aerograph work Two general methods are available. The print may be covered with Cellophane, or it may be varnished.

Cellophane-facing : Sheets of ordinary wrapping Cellophane are soaked for 5-10 minutes in water and are then squeegeed on to a ferrotype plate. The prints, if unhardened, are taken from the washing water, squeegeed on to the Cellophane and stacked up under pressure with a pair of blotters over each print, and left for several hours. They are taken from the ferrotypes while still damp and dried between blotters under light pressure. If the prints have been hardened they should be soaked for 10 minutes, before squeegeeing in water at 120°F.

Varnishing : A varnish is made up by diluting printer's white spirit-varnish, as used for show card finishing, with a little turpentine mixed with spirit. The varnish is applied with a circular motion with a piece of cotton wool. It requires half a day for drying.

Excellent commercial varnishes are also available.

Ink Drawings from Prints

Particularly in engineering and commercial advertising it is often necessary to prepare line-drawings from photographs. This is done by drawing or lining in the photograph with waterproof Indian ink and then bleaching out the image completely in iodine-cyanide, or iodine-thiocarbamide (see under Reducers) or the following copper bleacher:

Copper sulphate (cryst.) ...	2 ozs. 5 grs. (100 gms.)
Common salt	2 ozs. 5 grs. (100 gms.)
Sulphuric or hydrochloric acid (concentrated)	½ oz. (25 c.c.s.)
Water	20 ozs. (1,000 c.c.s.)

Bleach the lined-out print in the above solution until only a faint image remains which will require 6 to 7 minutes; then remove the silver chloride residue in 20% to 30% plain hypo solution. After fixing there should be no trace of the original image. This method of removing the silver image is much quicker than when using the slow thiocarbamide-nitric acid bleacher.

Another useful method is to coat a good quality rag paper such as Whatman with a ferro-prussiate sensitiser (see "Iron Printing Processes"), make a contact blue-print, then, after lining in the image, bleach out in a 5 per cent. solution of sodium carbonate. The back of an old or rejected print is suitable for coating, since after wetting, which is necessary to develop the blue-print, the paper surface will take the Indian ink perfectly.

THE CARBON PROCESS

Procedure.—Tissue, *i.e.*, paper coated with a mixture of gelatine and pigment colour, is made sensitive by immersion in bichromate solution, dried, and printed under the negative by daylight. As the colour of the tissue hides the effect of light, the printing is done by aid of an actinometer.

The effect of the light is to render the gelatine insoluble—the greater the action, the deeper down into the tissue. "Development" consists in dissolving out in warm water the tissue which remains soluble.

As a skin of insoluble tissue is formed over the whole top surface of the print, the coating is first transferred, face down, on to a fresh support.

To do this, the exposed tissue is soaked in cold water along with a sheet of gelatine-coated transfer paper, the two squeegeed together, put under pressure for about 20 minutes, and then placed in hot water.

The original support of the sensitive surface is stripped off, leaving the tissue with its face (the insoluble side) on the transfer paper. The soluble gelatine can be then dissolved away, carrying the pigment with it, and the prints are finally passed through an alum bath, washed and dried.

As this transference of the print to a new support causes the picture to appear reversed as regards right and left it is necessary (where this is an objection) to transfer first on to a "temporary support" for development, and from this again on to the "final support."

Sensitising Solutions

Potassium bichromate	½ oz. (50 gms.)
Water	10-20 ozs. (1,000 to 2,000 c.c.s.)
Liquor ammonia, 0.880	30 minims (7 c.c.s.)

If the tissue be squeegeed on to a ferrotype plate, and allowed to dry upon it, the drying may be done in the light of an ordinary room. The face of the tissue is then protected from light, dust, and injurious vapours.

H. W. Bennett's formula:—

Potassium bichromate	120 grs. (28 gms.)
Citric acid	30 grs. (7 gms)
Water, to make	10 ozs. (1,000 c.c.s.)

To this, add liquor ammonia sufficient to change the orange-red colour to lemon yellow.

This bath is suitable for negatives which will yield good prints in contact bromide printing. Tissue sensitised in it will keep longer than that sensitised in the former solution, but it is much less sensitive. It is not suited for the very strong negatives usual in carbon printing.

Fixing or Hardening Bath

Alum	½ oz. (50 gms.)
Water, to make	10 ozs. (1,000 c.c.s.)

Bichromate Stains, Etc.

To remove bichromate stains from fingers, nails, etc., apply dilute ammonia to the parts until the stains disappear, then well wash the hands with warm water and soap.

Waxing Solutions

No. 1 formula is for carbon prints or for removing collodion films.

1. Beeswax	50 grs. (11.5 gms.)
Benzole ... rect. No. 1	10 ozs. (1,000 c.c.s.)

No. 2 formula is for flexible supports.

2. Yellow resin	180 grs. (41 gms.)
Yellow beeswax	60 grs. (13.7 gms.)
Rect. spirit of turpentine	10 ozs. (1,000 c.c.s.)

Carbon Transparencies

The following is a substratum for use in making carbon transparencies.

Nelson's No. 1 gelatine	⅜ oz. (37.5 gms.)
Water to	20 ozs. (2,000 c.c.s.)
Potassium ... bichromate	12 grs. (1.37 gms.)

Well cleaned plates are coated with this and dried, when they are fully exposed to light, which will render the coating insoluble.

Gelatine Solution

For transferring carbon pictures from flexible support to ivory, opal or clear glass, etc.

Nelson's No. 1 gelatine	½ oz. (50 gms.)
Water to	10 ozs. (1,000 c.c.s.)
Chrome alum	6 grs. (1.37 gms.)

The chrome alum is previously dissolved in 1 oz. (100 c.c.s.) of water and the solution added to that of the gelatine.

For coating drawing-papers for the single transfer process.

Nelson's No. 1 gelatine	½ oz. (50 gms.)
Water to	10 ozs. (1,000 c.c.s.)
Chrome alum	10 grs. (2.3 gms.)

Apply with a brush.

The chrome alum is previously dissolved in 1 oz. (100 c.c.s.) of water and the solution added to that of the gelatine.

In adding a solution of chrome alum is one of gelatine, both solutions should be at a fairly high temperature, 130° to 160°F.

THE CARBRO PROCESS

In this process a carbon print is made from a bromide print or enlargement without the aid of daylight.

A good bromide print must first be prepared, care being necessary to ensure correct exposure and full development. Weak, flat bromides give unsatisfactory results.

The print, which has been thoroughly washed and dried, is placed in a dish of clean water, and should remain in this until quite limp or until required.

The following solutions are required:

STOCK SOLUTION NO. 1.

(*For making Sensitising Bath.*)

Potassium bichromate	½ oz. (50 gms.)
Potassium ferricyanide	½ oz. (50 gms.)
Potassium bromide ...	½ oz. (50 gms.)
Water to ...	10 ozs. (1,000 c.c.s.)

Sensitising Bath for Use.

Stock solution No. 1	6 ozs. (100 c.c.s.)
Water	18 ozs. (300 c.c.s.)

This bath may be used repeatedly, but should be strained through fine muslin or cotton wool after use.

STOCK SOLUTION NO. 2.
(*For Acid-Formalin Bath.*)

Acetic acid, glacial ...	1 oz. (10 c.c.s.)
Hydrochloric acid, pure	1 oz. (10 c.c.s.)
Formalin	22 ozs. (220 c.c s.)
Water ...	1½ ozs. (15 c.c.s.)

The formalin is the commercial 40 per cent. solution of formaldehyde.

Acid-Formalin Bath for Use.

Stock solution No. 2.	1 oz. (10 c.c.s.)
Water	32 ozs. (320 c.c.s.)

Renew this bath frequently as contamination with " sensitiser " lessens its activity.

A piece of carbon tissue of the required size, which must be about ¼ in. larger each way than the bromide print, is "sensitised" by immersion for three minutes in the " sensitising bath " given above containing potassium bichromate, ferricyanide and bromide.

During this time the bromide print should be removed from the water and laid face upwards on a sheet of stout glass.

When the tissue has been in the " sensitising " bath for the requisite time it is removed, and allowed to drain for 15 seconds. It is then placed in the acid-formalin bath. The time of immersion in this solution varies according to the brilliancy desired in the resulting print, and may be from 15 to 25 seconds, the longer immersion giving greater softness.

The tissue is now laid face downwards upon the bromide print, and the two squeegeed into contact. A flat squeegee is used, and particular care taken that the tissue does not move on the surface of the bromide during the early stages of squeegeeing.

Both print and tissue are now lifted from the glass, and placed between greaseproof paper, where they are allowed to remain for 15 minutes. During this time a piece of transfer paper, similar to that used in carbon printing and larger in size than the tissue in use, is selected and placed in a dish of water.

If a thin transfer paper is used, allow it to soak for 5 minutes, while, if thick, 10 minutes will be necessary.

The transfer paper is then laid face upwards upon a sheet of glass, and is ready to receive the carbon tissue.

The bromide print and its adhering tissue should now be taken from between the greaseproof paper, and the two carefully separated by lifting one corner of the print and gently but decisively pulling the two surfaces apart. The bromide print should be dropped into a dish of water, and the tissue placed film down upon the transfer paper.

The tissue is then squeegeed to the support transfer paper, and the two placed between blotting paper for from 20 to 40 minutes. The bromide print, after well washing, may be re-developed for future use.

When the tissue and final support have been in contact for the required time they are placed in a deep dish of water at a temperature of 95° to 100° F. In a few minutes the pigmented gelatine begins to dissolve: colour oozes out at the edges.

The two papers are now separated by taking a corner of the tissue and gently pulling the two apart under the water. The majority of the pigmented gelatine will now be found upon the transfer paper, and development of the image is proceeded with by pouring warm water over the surface of the print. The image is very tender at this stage, and care should be taken that nothing touches its surface. When development is complete the print is transferred to a 3 per cent. solution of alum, and when all signs of yellowness in the highlights have disappeared, is washed for a few minutes in water, and then hung up to dry.

THE BROMOIL PROCESS

In this form of the oil process, a print, which should be on one of the papers made for the purpose, is bleached in a special tanning bleacher. This brings the print into a condition where, when damp, it will accept an oily ink in proportion to the original reduced silver.

Amidol is the safest developer, but M.Q. or Azol can be used. About half normal strength is best, and the print should be on the soft side. It should be fixed for five minutes in fresh 20% plain hypo, thoroughly washed, and dried. It is then soaked in water for five minutes, and bleached.

Stock Bleacher (Chris. J. Symes' formula).

Copper sulphate (pure) ...	14 gms.
Hydrochloric acid (pure strong) ...	3 drops
Potassium bromide ...	14 gms.
Potassium bichromate(pure)	0.75 gms.
Water (distilled or tap if soft) ...	350 c.c.s.

Add two parts of water for use. The stock solution keeps well.

After bleaching, the print is washed in several changes, fixed in 10% plain hypo for three minutes, washed, and dried.

The above bleacher suits a soft tap water (4 to 10 degrees hardness). With hard water add a trifle more acid, but not more than necessary to prevent the bleacher clouding during use.

To prepare it for pigmenting, the print is soaked for about half an hour in water at from 70° to 85°F. Soft water needs the higher temperature usually, but experiments should be made. The surface water is dabbed off firmly with a damp wash-leather, and inking begun with a stiff bromoil ink applied with the special brushes made for this work. It should only take on the shadows. After 3 minutes' resoak, slightly softer ink is applied, and after further resoaks at each stage, still softer ink until the high light detail appears and the print is considered finished. The brush should be more lightly charged as the ink is softened. There is no need to hurry. If the print is kept moist by frequent dips into the water and gently dabbed off after each, ink that has taken properly will not be disturbed, and the picture can be built up methodically and controlled as desired.

There is a " short " method of preparing the print in which the first fixing is omitted and the print bleached (in safe light) after rinsing out the developer. The rest of the process is the same, except that the final fixing should be for five minutes in 20% hypo. But with present-day papers the standard method is to be preferred until some experience is gained.

Processing temperatures should not exceed 65°F. if possible. Brushwork should be firm and decided, but not heavy.

SENSITISING PAPER & FABRIC

The following are formulæ for " salting " and sensitising papers, such as Whatman's drawing papers, and fabrics.

Prepare the plain paper with:

Ammonium chloride	60 to 80 grs. (7 to 9 gms.)
Sodium citrate	200 grs. (23 gms.)
Sodium chloride	40-60 grs. (5 to 7 gms.)
Gelatine ...	20 grs. (2.3 gms.)
Distilled water, to	20 ozs. (1,000 c.c.s.)

or—

Ammonium chloride	200 grs. (23 gms.)
Gelatine ...	20 grs. (2.5 gms.)
Water, to make ...	20 ozs. (1,000 c.c.s.)

The gelatine is first swelled in cold water and then dissolved in hot water, and the remaining components of the formula are added. The solution is filtered, and, when still warm, the paper floated upon it for three minutes and dried.

Sensitise the salted paper on a neutral 45-grain silver bath.

The sensitised material keeps only a few days. It needs a very vigorous negative and should be appreciably overprinted, as it loses depth in toning and fixing.

Platinum Toning Bath.

Potassium chloro-platinite	9 grs. (1 gm.)
Water	20 ozs. (1,000 c.c.s.)
Nitric acid ...	4-6 drops (7-10 drops)

The fixing bath should be slightly alkaline to neutralise any acid remaining in the print. A good formula is :

Hypo	3 ozs. (150 gms.)
Sod. carbonate 10% sol.	240 minims (28 c.c.s.)
Water, to make	20 ozs. (1,000 c.c.s.)

Gold Toning.

A very satisfactory toning bath, which may be kept as a stock solution, is:

Gold chloride ...	15 grs. (1 gm.)
Sodium acetate	450 grs. (30 gms.)
Water, to make	35 ozs. (1,000 c.c.s.)

For use, dilute 1 part with 7 parts of water. Allow one ounce for each whole plate print.

A good black tone may be obtained by toning first in gold and then in platinum. Whether gold alone, or gold and platinum are used for toning, the alkaline fixing bath given above should be used.

COLOURING, WORKING UP, SPOTTING, RETOUCHING, ETC.

COLOURING PRINTS

The colouring of prints tastefully and in such a way that the applied colours do not intrude on the general effect, depends largely on the natural aptitude or ability of the worker. Some experience in the creative use of paints generally is an asset, and undoubtedly an artist, or at least one with training in the use of colours of all types, will be most successful. Professionally, the standard is high and the use of pastel chalks and dyes, so tempting to the unskilled, is mostly confined to work of inferior class and low price. At the same time, these mediums can form a suitable introduction to colouring, and their restrained use can produce quite pleasing results. Professional work of the very highest standard is mainly confined to water colours as the predominant medium, with perhaps the discreet use of pastels and/or dyes where their use is justified.

Pastel Chalks.—These, and powder colours, have a certain opacity which makes their use limited, but lightly applied can give a very pleasing suggestion of colour. Suitable paper surfaces are, however, limited, and smooth (not velvet or semi-matt) rather than a dead matt surface should be selected, a typically good example of such a paper being Barnet Platino-Matt Smooth bromide paper.

Preparation of the surface consists of lightly rubbing with superfine pumice powder, after which the chalks can be applied with tufts of cotton wool of various sizes. For very fine work, a small tuft of cotton wool can be screwed round the end of a thin stick of wood. Alternatively, small pieces of chamois leather are capable of very effectively applying the chalk, which should be first rubbed on to cartridge paper as a palette, from which the colours are taken by the wool or chamois as required. Details which have been obscured by the chalks are easily cleaned by wedges or points of indiarubber ready for receiving the colour best suited to fine detail. For eyes, lips, small dress ornaments, or clothing details, which are too fine for pastel colouring, water colours or dyes may be used. Small prints are difficult to colour in this manner, and usually nothing smaller than half-plate size should be attempted. Large head studies are the most suitable for a first attempt and matters are considerably simplified if the print is in fairly high key and sepia toned. For either views or figure studies, avoid over-colouring, which is inseparable from a certain ghostly appearance due to opacity of the chalks. Fixing of pastels is effected either by water sprayed on by the air-brush, or by submitting the surface to kettle steam. Alternatively, a fixative for either crayon or pastel consists of 24 grs. (1.55 gms.) of mastic dissolved in 3 oz. (85 c.c.s.) of amyl acetate. This medium is dissolved by agitation and allowed to stand for some hours before mixing as follows: Prepare by agitation a solution of 7 grs. (0.45 gms.) of celluloid (nitrate film) in 3 oz. (85 c.c.s.) of amyl acetate. When both solutions are clear mix them together and keep in a tightly corked bottle. Apply with spray diffuser.

Crayons.—Broader effects such as large heads printed on rough or medium rough papers can be obtained by the use of artists' coloured crayons, but these require the utmost skill as possessed only by artists accustomed to using this medium in creative drawing.

Water Colours.—Water colours of a transparent nature from one of the most suitable mediums for skilful colouring of prints. It must first be decided whether the colour is to be "washed on" or "stippled" or a combination of the two is to be used. Prints on matt or grained surface papers are suitable, as also are velvet or semi-matt papers, and these may be used dry or damp according to the preference of the worker. The colours are then applied as in the case of ordinary water colours on drawing paper. The absorbent nature of the gelatine surface is a hindrance in this kind of work, and usually a second wash cannot be added over a previously applied tint. Hence if any additional depth is required, or if any further details or modelling are necessary, "stippling" or "hatching" must be resorted to, the effectiveness of which depends entirely on the worker's patience and skill.

For water colours, a large print is desirable, and for portraiture particularly, a warm brown or even sepia. Some may prefer a deeper print, which may tend to degrade the shadow colouring, though it must be conceded that it provides better modelling in the lights. Only the finest quality brushes should be used, either camel hair or preferably sable. Failure of the colour to run evenly over the print surface can be cured by a final rinse of the print in dilute wetting agent or by applying such a solution to the print surface before starting to colour. This takes the place of the purified ox-gall once used. Lakes or poster colours which contain body pigment are entirely unsuitable, and in the interests of permanence, only artists' (not students') quality transparent water colours should be used. The following are recommended :

> Alizarin Scarlet, Scarlet Madder, Scarlet Lake, Burnt Sienna, Burnt Umber, Raw Sienna, Charcoal Grey, Paynes Grey, Prussian Blue, Antwerp Blue, Cobalt Blue, French Ultramarine, Naples Yellow, pale and deep, Cadmium Yellow, Green Oxide of Chromium, Lemon Yellow, Lamp Black and Ivory Black are useful, but they can scarcely be classified as transparent. Yellow Ochre, too, is a useful colour, but must be used in pale tints, since a deep wash is not very transparent.

Transparent Water Colours, or Dyes.—Distinct from water colours of the type just mentioned are dye solutions which are sold by most dealers in sets of varying size and price. These are the only absolutely transparent water colours and are equally suitable for colouring prints and lantern slides. They are evenly laid on, and in consequence the modelling as seen through the dye appears as such and loses nothing in character. With ordinary water colours, the tints cannot be strengthened by additional layers, but in the case of dyes, depth of colour can be obtained by additional applications to any degree of brilliancy. Alternatively, shading or modelling can be strengthened after the main tints have been applied, but again, unlike water colours, the dyes once applied cannot be completely washed off. If, however, the tint is too deep, soaking in water, or in a weak solution of sodium carbonate will reduce depth. The safest plan is to build up depth to the required degree by successive washes of pale tints. Various colours can, of course, be obtained by mixing, and as a precautionary measure colours should first be tried out on an old print. The use of wetting solution either in the final rinsing water of the print or in the process of damping the print prior to tinting facilitates the even spreading of the colour. The damped print should lie on a firm support, such as glass, whilst the colours are being applied.

Colouring Lantern Slides.—Only transparent dyes must be used for this class of work and the method of application differs only in the depth of colour required and the greater degree of accuracy and patience demanded by reason of the small area to be coloured. There are various methods of applying the colours, but for the beginner, the safest is perhaps to colour the slide by sectional stages. Starting with a dry slide, the section first to be coloured, say, a sky, should be evenly damped with clean water, taking care that the line where the sky meets the horizon, broken by detail or otherwise, is carefully lined in with water using a fine brush. Then wash the damped area over with the required blue, alternatively applying the colour and swabbing it off with a smooth mop brush, and shading in with deeper colour by the same means. Clouds, of course, should be outlined with water and left dry, so that the wash of colour flows round them. When this coloured part is dry, "stencil" in the other details in the same way. When the broad colours have been applied the whole slide may be damped by the addition of fine detail with a small fine-pointed brush. As experience is gained, work on a completely damped slide may be undertaken, remembering that as the slide is to be projected by transmitted light brush marks are more easily seen than on a print. As an easel, use a large sheet of glass supported fairly high above a piece of brightly illuminated white paper. When washing on large amounts of colour, tilt the glass so that the wash will flow away from other portions of the slide. In all forms of colouring it is essential that plenty of clean water is available and that brushes are kept clean. After use, brushes must be washed, and wiped to a point with a clean rag and dried standing upright. On no account should they be left with the hairs or bristles lying on the bottom of a water container.

Oil Colours.—Colouring in oils probably presents the greatest difficulty in that experience in preparing them to the correct consistency requires the skill acquired of long practice, and, generally speaking, some skill in the ordinary use of such colours is necessary. Only transparent colours are suitable, and these are, as a rule, similar in name to the corresponding water colours. They must on no account be mixed with white or other opaque body colour. The print surface must be prepared by application of a medium, preferably that particular to the make of oil colour selected, although ordinary megilp thinned with rectified turpentine can be used, or the latter mixed with about one-third of its volume with artists' linseed oil. Only a trace of medium should be used. The colours are applied with a piece of soft rag for large areas or tufts of cotton wool or brushes for smaller details.

Air-Brush Colouring and Process Retouching.—For large areas, water colours can be applied evenly by the air-brush, and unlike such colours applied with a brush can be laid one over the other. Specially prepared colours are available from artists' colourmen, although they can be mixed to the correct consistency from tubes provided there is no grit present in the water used to mix them.

A variation of this process is used by process artists to " retouch " photographs intended for half-tone reproduction. Black and white are the only pigments used and the various shades of grey are obtained by mixing. Opacity of the layer is essential in order that imperfections of the print are covered up. Process "retouching" requires a high order of skill not only in the control of the air brush, but in the accurate use of masks both of paper and special masking compounds. To broadly illustrate the principle, suppose the rectangular side of a machine requires to be tidied up and, perhaps, altered in tone. Straight-edge masks of tracing paper are accurately laid round the edges and held down with strips of, say, lead. Then the appropriate tone is evenly laid on with the air-brush, beginning with the lightest shade and after re-charging the "brush" shading in the darker parts. Lining in of fine detail is done with a very fine sable brush or ruling pen for straight lines. Usually a glossy print is preferred so that the grain of the pigment is as fine as possible. In addition to overall refinement of the subject, one important aim of "retouching" is to separate tones and provide a scale which will compensate for "half-tone" loss in the process of reproduction. Skilful process "retouching" also eliminates to a great extent the need for fine-etching.

Ghosting-Out Backgrounds.—What is known as "ghosting" is effected by subduing the background with an even layer of white paint thinly applied with the air-brush, during which time the actual subject is protected by a suitable paper mask. The subject will then appear in bold relief although still in relation to the surroundings which will be greatly reduced in density.

RETOUCHING, SPOTTING, WORKING-UP, ETC.

Retouching the Negative.—A negative will not normally take the lead pencil without the addition of an applied "tooth," and this usually consists of a resin dissolved in turpentine or an organic solvent such as benzene or xylol. There are several first-class commercial makes available, but the following by Cleveland Hood is suitable:

Dammar	½ oz.
Turpentine	2 oz.
Xylol or Benzol	8 oz.

To dissolve the dammar, shake the container at intervals and filter, using the less toxic xylol for preference.

To prepare the negative, lay it down on a piece of clean paper at least 3 inches larger all round, then take a 2-inch square piece of clean rag made into a pad and saturate it with medium. Apply this to the emulsion side of the negative, but not so liberally that it flows underneath, then immediately smooth out the coating with a large pad of soft rag, as for instance a piece of old cambric or lawn handkerchief, working with an even circular motion until some slight resistance is felt. At this point the medium should be evenly and thinly coated without streaks, which if present in a negative of low density will be visible in the print. It may be necessary to thin down the medium if it dries too quickly, or is too tacky, and this may be done with a little turpentine added cautiously.

Applying the Pencil.—Place the negative in a suitable retouching easel, so that it is illuminated sufficiently to penetrate the densest part which it is required to retouch. By dot, circle, hatch or short stipple apply the pencil evenly until the density is brought up to the required depth. The medium should give tooth, but no drag, and the deposit of any graphite powder on the negative surface must be avoided. Pencils may range from grade B to 3H or even harder and the points should be kept long and sharp. Finish off the points by fine glass paper, but before using wipe off all the roughness and loose graphite with a piece of rag. As work continues, the points may be reconditioned by lightly rubbing on a piece of smooth paper.

Heavy retouching may be applied by working on both sides of the negative suitably coated with medium, and all work may at any time be removed by swabbing off with turpentine or benzene.

Blocking-out, etc.—Blocking-out of backgrounds in commercial and engineering subjects is often necessary so that the subject may stand in a white background permanently, or to enable a new background to be drawn or painted in. Such blocking-out is carried out by hand on the negative which is placed in the retouching easel prior to lining in the subject round the edge with brush or ruling pen. As in the case of tracing, put in all the curves first, which is best done with a firm sable brush and an opaque medium such as " Photopake " or that sold by Johnsons. Next rule in all straight lines to meet the curves until the subject is completely enclosed by an accurately drawn opaque line. Finally paint out the remainder of the area outside the line and meeting it, after which the negative is ready for printing when dry. Sable brushes Nos. 1 to 6 are preferable, the large size being used to fill in the main area of pigment. Always keep the opaque medium well-stirred, and avoid tear drops and uneven patches. A little wetting agent will facilitate the spreading of the medium.

Indian red water colour thinned down sufficiently with water forms a good blocking-out mixture as also does jewellers' rouge mixed with water to which is added a little gum arabic solution. It should be noted that a background is more easily blocked out, particularly in the case of intricate machine details, if the subject is photographed in front of a white paper or other background so placed to avoid heavy shadows being cast on it.

Negative Spotting.—Pinhole and air bubbles as well as other blemishes are best spotted out with negative dye of suitable density. Several suitable brands are marketed, such as Martin's and Johnson's, but water-soluble nigrosine and naphthalene black dissolved in water are suitable. For very small bubbles and pin-holes any opaque pigment or a mixture of Indian ink and Paynes grey water-colour mixed with water serve the purpose. Use a No. 0 or 1 sable brush or mapping pen, remembering that the object is to avoid a black spot on the print. Opaque spotting of the negative means a white spot on the print which can more easily be matched up with paint of suitable colour.

Spotting of Prints.—Obviously, the aim is to fill in any spots or blemishes of incorrect density with paint or pigment of a matching colour. For bromide prints, Paynes grey and Indian ink, or process black and white with Paynes grey or blue water-colour added will match up most shades of blue-black or grey. For sepia prints, use burnt umber, either alone or mixed with Indian ink or process black. According to the surface of the paper, a little gum arabic can be added to the pigment. In the case of glossy prints, a black dye is preferable since the gloss of the gelatine is not covered. Or, if no dye is at hand, the pigment may be covered over with a spot of retouching medium, or glossy negative varnish. The now little used

P.O.P. and self-toning papers can be spotted with Paynes grey and Indian ink mixed with carmine.

Powder and Stump Finishing.—Although now not so commonly used, graphite powder and stumping chalk can darken large shadow areas. These are applied as in the case of pastel chalks, with paper stumps, or chamois leather or cotton wool. Even powdered graphite from a lead pencil makes a good medium for vignetting if it is taken from a coarse paper palette. In the case of a blocked-out head, for example, treat the paper surface with pumice, then, using a tuft of cotton wool lightly, lay on an even layer of powder, an operation which is often easier if a little pumice is mixed with the powder. Using an indiarubber wedge, vignette the edge of the powder background, and then put in diagonal high-light flashes with the rubber wedge or re-touching knife. This is reminiscent of the old sketch portraits which if tastefully done can still be effective, and has been revived in some parts of the U.S.A. In the case of blocked-out machine subjects a floor can be vignetted in by the same method and shadows and reflections added by the skilful use of the knife and indiarubber.

Dopes.—The use and necessity for dopes and brightening medium is controversial, but in certain cases a print is rendered more brilliant by the application of such a medium. Several commercial brands are available, but one of the most reliable is known as encaustic paste, consisting of the following:

Purified beeswax	50 parts
Oil of lavender	30 „
Benzol	30 „
Gum elemi	1 „

Rub a small quantity of the paste over a smooth matt or rough matt paper print to impart brilliance. Apply the paste with the ball of the finger or piece of soft rag, then polish off so that no streaks or marks are visible.

TITLES ON NEGATIVES

Words forming the title may be set up in type and copied from a "pull" on to a stripping paper or thin line film, or the copy can be from text set up on a cine titling outfit or even typescript. The copy, negative or positive as the case may be, of the required size is then carefully inserted in a space on the negative to be titled from which the gelatine has been carefully scraped away. Secure the title strip to the film with a cellulose adhesive, and after filling in the thin lines of clear glass or film round the title, square it off neatly with the ruling pen and opaque medium. For subjects with a foreground of low negative density, the title letters may be positive, viz., black on clear film, in which case the title strip is lightly attached to the film and printed without further preparation.

Hand-written titles on film can be inscribed on the backing side, in which case they are written the correct way round. In the case of glass plates, however, this is not possible and the letters must be written the reverse way round, but to overcome this the title may be written on a piece of thin, fixed out film or "Cellophane" and attached to the emulsion side of the plate, making sure that it reads correctly when printed.

NON-PHOTOGRAPHIC TITLES AND DIAGRAM SLIDES

H. A. Robinson (B.J., 22nd October, 1937, p. 680) suggests using a lantern slide cover glass coated with Canada balsam as a base on which to draw or paint titles. The coating solution consists of a piece of Canada balsam no larger than a pea dissolved in 2 ozs. of benzol. Keep well corked and apply with one wide sweep with a soft brush or by flowing as in applying varnishes. Dry the slide with considerable heat, and the thin coating resulting will be found to take Indian ink without bubbling, also transparent oil colours suitably thined with turpentine. Unlike other mediums similarly coated, Canada balsam will not soften in the lantern, being in fact hardened by such heat. If desired, some of the balsam solution may be mixed with the colours and then painted directly on to a plain uncoated slide.

MOUNTANTS

Dry Mounting

The neatest and most efficient method of mounting photographs. A piece of specially-prepared tissue is lightly attached to the back of the print by the aid of a small hot fixing iron. The print with tissue so attached is now trimmed to the required size and registered in position on the mount to which it is temporarily secured by further use of the fixing iron. This temporary attachment prevents the print moving during the final process, which consists simply of pressing the print and mount between the fixed base and the hot top plate of the dry-mounting press.

The process is simplicity itself and success is assured if the mount and print are reasonably dry and the press is heated to the correct temperature; normally 180 to 200 deg. F. is correct, but particularly for "Ademco" tissue the recommended temperature is now 140 to 150 deg.F. A lower temperature will not melt the tissue, whilst a very hot press will damage the surface of the print.

Small prints on thin paper may be dry mounted using a domestic flat iron, but large sizes, particularly of double-weight thickness, do not respond satisfactorily to this method, since an even all-over pressure is necessary to give a smooth surface and perfect adhesion.

Starch Paste

Mix pure starch powder with a very small proportion of cold water to form a very stiff mass. It should be so stiff that it is stirred with difficulty.

Perfectly boiling water is then poured on, about 12 ozs. for every ounce of starch.

On stirring the mixture will jellify without being boiled; but if it does not it is brought to the boil, cooled, the skin taken off and the paste used on day of making.

Dextrine Paste

Dextrine, best white	13¾ ozs. (687 gms.)
Water at 160°F.	20 ozs. (1,000 c.c.s.)
Oil of wintergreen	5 minims (0.5 c.c.)
Oil of cloves ...	5 minims (0.5 c.c.)

Place the water in a vessel standing in a larger vessel of water kept to within 1° of 160°F. Stir in the dextrine slowly, and when it has all dissolved add the two preservative oils, stirring all the time. Then allow to cool, pour into bottles, and cork. Put aside in a cool place for a week or two for the mixture to congeal to a firm white smooth paste.

Starch-Gelatine

A.	Bermuda arrowroot	8 ozs. (200 gms.)
	Water	4 ozs. (100 c.c.s.)
B.	Nelson's No. 1 soft gelatine	350 grs. (20 gms.)
	Water	64 ozs. (1,600 c.c.s.)

The gelatine is first softened in the water, and A and B are then mixed together and boiled for a few minutes. To the cold mixture are stirred in :—

Methylated spirit	5 ozs. (125 c.c.s.)
Carbolic acid (liquid)	25 minims (1.3 c.c.s.)

This is a good cold paste, which sticks and keeps fairly well.

Gelatine

Nelson's No. 1 gelatine	4 ozs. (50 gms.)
Water ...	16 ozs. (200 c.c.s.)

Soften the gelatine in the water, liquefy on a water bath, and add (a little at a time and stirring rapidly) :

Methylated spirit	5 ozs. (60 c.c.s.)
Glycerine ...	1 oz. (12 c.c.s.)

The mountant is used hot. A piece of ground glass is dipped in hot water, drained, and the mountant brushed over it. The print is then laid face up on the frosted surface and rubbed gently in contact with a piece of paper, being then removed and pressed down on its mount.

Liquid Gelatine

Gelatine ...	1 oz. (100 gms.)
Water ...	6 ozs. (600 c.c.s.)
Chloral hydrate	1 oz. (100 gms.)

The gelatine is dissolved in the water by aid of heat, and the chloral hydrate added. After digesting for a short time the adhesive liquid is neutralised with a little sodium carbonate solution.

Shellac Mountant

A strong solution of shellac in methylated spirit, or better, rectified spirit, is thinly applied to both mount and print, and the two coated surfaces quickly rubbed into contact. This is a good method of fixing prints to thin mounts in albums, etc.

Rubber Solution

Clear rubber solution forms a useful mountant, especially for photomontage where one print has to be mounted on the face of another. The solution is applied very thinly to both surfaces with the edge of a flat strip of vulcanized fibre or springy metal and pressed into contact.

Fixing Paper to Metal

Tragacanth ...	1 oz. (60 gms.)
Gum arabic	4 ozs. (240 gms.)
Water	16 ozs. (1,000 c.c.s.)

Mounting on Glass

Prints on gelatine printing paper may be mounted face down on glass with a solution of gelatine. (See below). Prints mounted in this way were formerly largely sold as " opalines."

Nelson's No. 2 soft gelatine	1 oz. (30 gms.)
Water ...	10 ozs. (300 c.c.s.)

The gelatine is soaked in the water, and liquefied by standing the vessel in hot water. The solution is thinned down until nearly as thin as water. Print and glass are immersed, removed together, and squeegeed together.

LANTERN SLIDES

Lantern plates fall into three main groups, viz.:—

Rapid (Black-tone).—These are in many respects similar to bromide papers in their manner of use and require to be handled in the dark room under an orange or yellow safe-light. For black tones an exposure allowing full development in 2 minutes is recommended, a normal amidol or M-Q bromide paper developer being suitable. Some varieties allow warm tones to be obtained, but for this purpose it is more satisfactory to use the warm-tone plates described later. Rapid lantern plates are especially suitable for printing by enlargement or reduction, and when the closest tone reproduction is required.

Slow (Warm-tone).—Possessing qualities similar to chloro-bromide papers, these plates give warm tones under identical conditions; although slower than rapid plates they must be handled under an orange or yellow safe-light. Slides of rather strong contrast and great brilliance are obtained under normal conditions of exposure and development, but with a diluted and restrained M-Q developer, or any of the special formulæ given in this section, warmth of tone and contrast can be controlled easily.

Gaslight, etc.—Plates of slow speed for use under the same conditions as apply to gaslight papers, although inspection during development is carried out much more comfortably under a yellow safe-light. They are too slow for projection printing, but are very suitable for printing (by contact) line diagrams or negatives which are excessively soft, or lacking in contrast. For blue-black tones develop for 30 to 60 seconds in any good gaslight formula. With appropriate increase in exposure and development in a diluted and restrained M-Q developer, warm tones are easily obtained. Brown, sepia and red tones result from treatment similar to that prescribed for chloro-bromide papers.

Development.—A lantern slide is judged by the range and quality of its tones as they appear by transmitted light. Consequently, it is difficult to determine the required time of development by the appearance of the image as the slide rests in the dish. As compared with a bromide or gaslight print a correctly developed slide would appear considerably over-developed when viewed in the dish, or even by the transmitted light of the dark-room lamp. Once this difference between printing on paper and on glass plates has been appreciated, the chief difficulty in lantern slide making disappears. In regard to density as distinct from tone, some rough idea as to how a slide should appear in the dish is indicated by noting the depth of density of a good quality finished slide as seen in contact with a sheet of paper. Factorial development may be used, but even by this method initial tests based on visual estimation of density are required in order to connect the factor with some desired result.

The development of a plate to a warm-black or dark sepia is carried to about the same visual standards as required for cold tones, but exceptionally warm tones such as brown and red may seem to lack density due to yellowness of the surface image. In special cases where any pleasing tone has been obtained repetition is only possible by making careful notes of the exposure and development times, and the nature, temperature and dilution of the developer. It is a good plan for the beginner to carry out development tests on small strips cut from a lantern plate by a wheel cutter or diamond, thus avoiding waste.

All slides, after development, should be quickly rinsed before acid-fixing, and must be hardened and thoroughly dried prior to binding. After-treatment may consist of reduction, intensification or toning as demanded by the deficiencies of the slide or the particular effect desired.

Diagram Slides.—These are often required for educational and lecture purposes. The design or drawing is copied to lantern slide size in the ordinary way on to process or line film, and developed in a high contrast developer. Printing is on black-tone or gaslight plates which should be backed, and development carried out to obtain maximum contrast. Evidence that all lines are fully recorded is indicated by the appearance of a faint background which can be afterwards removed by a weak solution of Farmer's reducer. When a diagram slide is required urgently, the subject may be copied to size on stripping film, and the gelatine film after hardening finally bound between two cover glasses. If backed plates are not available, an efficient backing may consist of "Photopake" or similar water-soluble light-absorber painted on the glass side of the plate.

Slides from Prints.—Also for lecture purposes, slides may be required from prints for which no negatives are obtainable. These as in the case of magazine illustrations, are simply copied on to a fine-grain ordinary or commercial film or plate to the required size and printed as ordinary slides. The copy negatives should be fully exposed and of somewhat higher contrast than ordinarily required for printing on paper.

DEVELOPERS FOR WARM BROWN TONES
on Chloro-Bromide Plates

Any of the formulæ recommended for chloro-bromide papers (see under "Bromide, Chloro-bromide and Gaslight Papers") may be used to obtain tones ranging from warm-black via sepia to red. The following three formulæ, however, are those advocated by prominent expert makers of lantern slides. Each will produce slides of very great transparency and rich quality. The results are distinctly superior to those produced by the addition of either ammonium carbonate or thiocarbamide, which tend to give a semi-opaque image.

Pyro-Ammonia (E. Dockree).

A.	Pyro	80 grs.	(18.3 gms.)
	Sodium sulphite (cryst.) ...	220 grs.	(15 gms.)
	Sulphurous acid	7 drachms	(88 c.c.s.)
	Distilled water to	10 ozs.	(1,000 c.c.s.)

B.	Ammonia .880	2½ drachms	(31.2 c.c.s.)
	Ammonium bromide	250 grs.	(57 gms.)
	Distilled water to	10 ozs.	(1,000 c.c.s.)

Take equal parts of A and B. Develop 2-3 mins.

Hydroquinone-p-Aminophenol (concentrated) (J. W. Shaw).

A.	Hydroquinone	80 grs.	(18.3 gms.)
	Sodium sulphite (cryst.)	1 oz.	(100 gms.)
	Citric acid	30 grs.	(6.9 gms.)
	Potassium bromide	15 grs.	(3.4 gms.)
	Water, to make	10 ozs.	(1,000 c.c.s.)
B.	Caustic Soda	80 grs.	(18.3 gms.)
	Water, to make	10 ozs.	(1,000 c.c.s.)

For use, mix as follows:—

Solution A	2 drachms	(24 c.c.s.)
Solution B	2 drachms	(24 c.c.s.)
"Azol" or "Kodinol" (concentrated)	5 minims	(1 c.c.)
Potassium bromide (10% sol.) ...	1 drachm	(12 c.c.s.)
Water	1 oz.	(100 c.c.s.)

Development 2-2½ mins.

Specially recommended for soft brown black tones of great richness on warm-tone plates.

Shaw's original formula specified the old Agfa "Rodinal" concentrated p-aminophenol-caustic developer, which is at present not available. In place of this we suggest that one of the British p-aminophenol concentrated developers should be tried, such as "Azol", "Certinal" or "Kodinol".

H. W. Bennett's Pyro-Soda Lantern Plate Developer (Revised by Arnold Jowett).

For either warm-tone or black images on normal types of lantern plates.

A.	Citric acid	44 grs.	(10 gms.)
	Sodium sulphite (anhyd.)	360 grs.	(82.5 gms.)
	Pyro	88 grs.	(20 gms.)
	Water, to make	10 ounces	(1,000 c.c.s.)
B.	Sodium carbonate (anhyd.)	268 grs.	(61 gms.)
	Water, to make	10 ounces	(1,000 c.c.s.)
C.	Potassium bromide	88 grs.	(20 gms.)
	Water, to make	10 ounces	(1,000 c.c.s.)

For normal use, take 1 part A, 1 part B, and 2 parts water. If still warmer tones are required take 1 part each A, B and C, with 1 part water. Time of development 4 to 8 minutes according to tone required.

From the above three-solution formula can be made the modified Delaye pyro surface developer, described in "Pyro-Yesterday and Today" (1949 Almanac, pp. 94-100).

Water	12 ounces (910 c.c.s.)
B Solution	6 drachms 24 minims (40 c.c.s.)
A Solution	1 ounce (50 c.c.s.)

(Add water to above to bring volume to 20 ounces.)

To make B.J. Non-Staining Pyro-Soda Developer from the revised Bennett's formula:

Water	10 ounces	(540 c.c.s.)
B Solution	4 ounces 288 minims	(230 c.c.s.)
A Solution	4 ounces 288 minims	(230 c.c.s.)

(Add water to above to bring volume to 20 ounces.)

In preparing the above, it is important to mix the B solution with water first, then quickly stir in the A solution.

Mixed as a Pyro-Surface Developer, the colour of the solution will be faintly pink. The formula works well as a tank developer. It does not stain the fingers and the colour of the solution changes very little after use. Use the solution at 70 deg. F. preferably and discard after using once.

Chlorquinol (For Slow Plates).

An excellent developer for warm tones is as follows:

Sodium sulphite (cryst.)	¼ oz.	(25 gms.)
Sodium carbonate (cryst.)	¼ oz.	(25 gms.)
Potassium bromide, 10% solution ...	100 minims	(20 c.c.s.)
Chlorquinol	30 grs.	(7 gms.)
Water	10 ozs.	(1,000 c.c.s.)

Development should take from 2½ to 4 minutes at 65° F.

For warm brown tones add 25 minims of 10% potassium bromide solution to each ounce of the above chlorquinol developer (5 c.c.s. to every 100 c.c.s.) and give three times the normal exposure.

For reddish tones add 50 minims of 10% potassium bromide solution to each ounce of the above chlorquinol developer (10 c.c.s. to every 100 c.c.s.) and give 8 times the normal exposure.

NOTE.—Glycin may replace chlorquinol if the sodium carbonate is increased 50 to 60%. It may then be necessary to decrease the potassium bromide.

Thiocarbamide

The thiocarbamide developer for lantern slides is one which yields a wide range of colours by simple development, ranging from magenta red through warm brown, cool brown, purple to blue and bluish-grey, and on to neutral grey and black. The warmer colours are obtained by greatly increased exposure.

Stock Solutions.

A. Metol	22 grs.	(5 gms.)
Hydroquinone ...	11 grs.	(2.5. gms.)
Sodium sulphite (cryst.)	½ oz.	(50 gms.)
Sodium carbonate (cryst.)	½ oz.	(50 gms.)
Water, to make ...	10 ozs.	(1,000 c.c.s.)

B.	Ammonium carbonate ...	1 oz.	(100 gms.)
	Ammonium bromide ...	1 oz.	(100 gms.)
	Water, to make	10 ozs.	(1,000 c.c.s.)
C.	Thiocarbamide...	33 grs.	(7.5 gms.)
	Ammonium bromide	11 grs.	(2.5 gms.)
	Water, to make	10 ozs.	(1,000 c.c.s.)

The chief difficulties in thiocarbamide development are (1) judging the correct density, (2) obtaining the desired colour.

The slide passes through a regular sequence of colour changes, beginning with yellow and passing thence to red, purple, blue-grey and ultimately black, although it is impossible to follow these changes with the eye during development. The problem thus becomes one of so adjusting exposure and developer that the correct density is reached at the same time as the desired colour.

Working developers: For warm-brown tones use A, 14 parts; B, 1 part; C, 1 part. For blue-grey tones, use A, 12 parts; B, 3 parts; C, 1 part. For warm black tones, use A, 10 parts; B, 5 parts; C, 1 part.

TONING LANTERN SLIDES

Bleach-and-Print-Out Methods

(1) For a fine brown tone bleach in mercuric chloride solution (as used for intensification), wash and dry.

(2) Bleach in one of the following solutions, rinse, remove the bichromate stain with weak potassium metabisulphite solution, wash and dry.

A.	Potassium bichromate	100 grs. (23 gms.)
	Hydrochloric acid	43 minims (9 c.c.s.)
	Water, to make	10 ozs. (1,000 c.c.s.)
B.	Potassium bichromate	100 grs. (23 gms.)
	Potassium bromide	50 grs. (11.5 gms.)
	Nitric acid	43 minims (9 c.c.s.)
	Water, to make	10 ozs. (1,000 c.c.s.)

C. Same as above, save that potassium iodide is used in place of bromide.

On exposure to bright daylight, the bleached slide gradually darkens. A slide bleached in A tends to warm brown; one bleached in B becomes cool grey; and one bleached in C, brown in colour.

Sulphide Toning

The indirect sulphide process—bleaching and sulphiding—as described for toning bromide prints, may be used for toning lantern slides which have been developed to a cool or warm black. This process produces a fine rich brown colour very transparent in character.

Other Methods

Any of the methods of toning described in the section on bromide papers may be used also for lantern slides. In general, however, chemical toning methods are inferior in the matter of transparency to the results obtained by direct development, particularly dye-coupled development as described by A. G. Tull in the 1939 *B.J. Almanac*. (There are now commercial toners available using this method.) Equally transparent and grain-free images are secured by the method of dye toning, in which the slide is first bleached in a solution which also mordants the image, which is then dyed by immersion in a solution of one of the many suitable basic dyes, or a suitable mixture of them, the silver image being subsequently dissolved out, giving a pure dye image of great transparency. Space does not permit the inclusion here of the formulæ for dye toning, but a full description will be found in "Photography: Theory and Practice," by L. P. Clerc.

Masking

Prepare strips of black "needle" paper 3¼ ins. long and of various widths from ¾ in. to 1 in.

One edge at least must be perfectly clean cut.

Lay the slide, film side up on white paper, moisten the surface of a suitable strip with the tongue and affix it on the slide so as to mask off the desired margin.

A sheet of ruled paper laid under the slide helps in placing the strips squarely.

Apply other strips to the remaining three sides and trim off projecting edges with scissors.

Finally, affix a white spot at the lower left corner of the slide as it appears when projected and proceed to the binding.

Binding

Select a brand of binding strips of thin, tough paper coated with strong adhesive and use the strips in one full length (13¼ ins.).

Lay the strip out, gummed side down, and moisten the back.

When the strip is limp turn it over, just moisten the gummed side and lay the strip, face up, on a yielding surface, *e.g.*, two thicknesses of blotting paper.

Cover the slide with a thin and carefully cleaned cover-glass, place one corner on the gummed

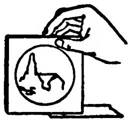


Fig. 1.

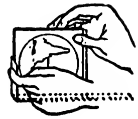


Fig. 2.

strip (Fig. 1) and press it firmly down.

Turn the slide over the edge (Fig. 2) and over again (Fig. 3).

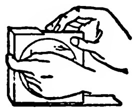


Fig. 3.

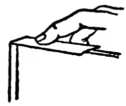


Fig. 4.

At each movement press the slide firmly down the strip and run the finger *along the edge only* of the strip to cause it to adhere to the slide (Fig. 4).

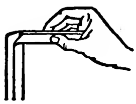


Fig. 5.

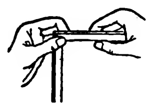


Fig 6

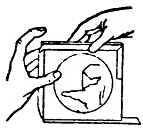


Fig. 7.

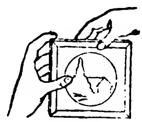


Fig. 8.

Now press the sides of the strip firmly against the glass, pushing the top end of the upright strip away from the glass (Fig. 5).

Continue in the same way with each corner, as in Figs. 5, 6 and 7.

The slide completely bound in this way is seen in Fig. 8.

A Simple Method

An alternative method extensively used is to use four short strips for binding, each one just under 3¼ ins. long, applying them separately.

PLAN-COPYING & RECORDING

IRON PRINTING PROCESS

Ferro-Prussiate Sensitiser

The following is a sensitising solution for paper to be used for printing by daylight and to be kept in good condition for a considerable time (months):—

A.	Ferric ammonium citrate (green)	2½ ozs. (250 gms.)
	Water, to make	10 ozs. (1,000 c.c.s.)
B.	Potassium ferricyanide	400 grs. (92 grms.)
	Water, to make	10 ozs. (1,000 c.c.s.)

Mix in equal parts, keep in the dark, and filter just before use.

If the ordinary brown citrate be used, the formula should contain 820 grs. (187 gms.), and the ferricyanide should be increased to 600 grs. (137 gms.).

The sensitiser is applied with a brush or sponge. The paper is printed until the shadows bronze, and is "developed" simply by soaking in one or two changes of plain water.

The following is a sensitising solution yielding a very much more rapid paper but of inferior keeping qualities, *i.e.* keeping in condition for about 60 days:—

Ferric ammonium citrate, 26% solution ...	6 parts
Ferric ammonium oxalate 10% solution ...	2 ,,
Ferric sodium oxalate, 10% solution ...	2 ,,
Ferric chloride, 7% solution	2 ,,
Oxalic acid, 10% solution	2 ,,
Potassium ferricyanide 10% solution ...	1 part

Solution for Writing Titles on, removing blue lines from blue prints, etc.—Potassium oxalate, 75 grs. per oz.; 170 gms. per 1,000 c.c.s.

Brightening the Colour.—Blue prints are improved in colour by a final bath of 2½% alum solution, 3% oxalic acid or 1% hydrochloric acid.

Over-exposed prints may be reduced by bathing in 10% potassium bichromate solution.

MODERN PLAN-COPYING METHODS

Plan-copying methods as used in large engineering and industrial concerns have undergone a considerable change in recent years. Not only has the quality and speed of plan-copying papers been increased, but a complete change has been made in the type of illuminant used to expose such papers. The modern method is to employ a number of high intensity discharge lamps in place of the old type enclosed carbon arc which, in addition to its inability to maintain a steady light over long periods, demands stoppage of the printing machine for cleaning, readjusting, and recarboning of the iamp. Typical of the several modern makes of continuous discharge lamp printers is the latest model made by Hall Harding, Ltd. This continuous high-speed printer suitable for all types of plan-copying papers employs six 1,000-watt Osram discharge lamps giving a printing speed on dyeline papers of 15 to 20 feet per minute compared with half the speed or less in the case of the old arc lamp machines. Methods of controlling the printing speed have also been greatly improved.

In regard to plan-copying papers themselves, perhaps one of the most striking changes taking place is the gradual replacement of the old water-developed ferro-prussiate paper by the semi-dry developed " Ferazo ", which is a modern scientific improvement of the old blue-printing methods. The washing and drying of the time-honoured blue print is always a bottle neck in the large-scale production of such prints, so that the elimination of the old cumbersome washing and drying equipment with its expensive upkeep has combined the super creaseless quality of " Ferazo " with economy and speed. " Ferazo " prints are developed with a special solution which chemically fixes the remaining ferric salts. This, however, is not a wash but is applied in much the same way as with diazotype prints by a power-driven developing machine. The blue of such papers is brilliant and permanent, and the white lines are clear and unveiled.

Where black or coloured lines are required on a white background, that is to say a positive print instead of the negative image as in the ordinary blue-print, Diazotype (dyeline) papers still hold the field. As in the case of " Ferazo ", development in one class of such papers is of the semi-dry variety the solution being a phenolic compound or allied substance which couples with the unexposed portions to form an azo dye. Efficient and largely used also are dyeline papers capable of being given totally dry and thus distortionless development by exposure to ammonia gas. The Ozalid Company, pioneers of diazotype printing, particularly in the field of dry development, have perfected a totally enclosed ammonia gas developing machine capable of keeping pace with the most rapid printing machine. Over older methods, this handsome machine has the advantage of containing a continuous and powerful supply of ammonia gas in the developing compartment without affecting the continuous feed. Practically no gas is liberated into the surrounding room space. Diazotype prints giving a white line on a coloured background (negative) are available, and most coatings can be applied on tracing paper and cloth, also " Cellophane " and similar substances. Such coatings lend themselves particularly to the totally dry development process.

To some extent, ferrogallic positive prints still survive, and are favoured by some architects who maintain that water colours are more stable on a completely washed base. For old or soiled cloth tracings or paper tracings many plan-copying experts aver that the old water-washed blue print gives a more readable copy than any other method, particularly if intensified by potassium bichromate.

An old process which is still persistent is the gelatine mass true-to-scale process, the greatest value of which is in the production of duplicate engineers' tracings. In this a specially prepared layer of gelatine is poured on to a flat support, and on to this when dry is applied face down an exposed but undeveloped ferroprussiate print. After a few minutes contact, the print is stripped off and the mass is in such a condition that the unexposed portion by reaction from the print will take up greasy ink whereas the exposed background will reject it.

In large departments a special table is used consisting of a windable endless belt of linoleum or other flexible material, the top of which is large enough to accommodate the largest size copy. One type of such table is known as the " Chalfont ", a description of which is found in Hall's book on Plan-Copying (Pitman, 1935). The advantage of such tables is in the fact that the available surface is over twice as great as the floor space, and is more economical in the quantity of gelatine mass required.

Although they do not come under the old heading of plan-copying in the exact sense of the term, several newer methods of producing letterpress copies and drawings are now included in modern departments. In this category is the photo-stencil silk screen process in which a light sensitised skin or tissue is printed down under a negative to provide when developed an ink stencil through which in conjunction with the silk screen ink is distributed to print on plain paper. Of such a type is the " Gestetner " machine, one of the valuable points of which is that short runs of say a dozen prints are possible without any great " make ready " wastage.

Systems closely allied to plan-copying and often coming within the scope of such departments are the true lithographic printing machines of the " Rotaprint " and " Multilith " types, which are ingeniously simplified to allow of being operated by rapidly trained personnel. These employ either aluminium or zinc flexible plates for offset printing on to which designs or letterpress and even half-tone illustrations can be printed down from negatives. Alternatively, typewritten matter may be applied directly on to the sheets as well as hand drawn legends and designs applied by special greasy crayons and special inks. Complementary to these processes are, of course, the true photographic process, viz., the " Photostat " and various types of reflex printing machines which are referred to under the heading " Document Copying ".

More and more in recent years has the use of normal photographic sensitive materials been called upon to assist plan-copying methods. Space does not permit the inclusion of all such aids, but " Duostat " Autopositive Contact Document Paper is one example. This remarkable product of Photostat Limited is a high-contrast material giving a positive copy direct from a positive original with development in an ordinary M-Q developer. Thus from either a single or double-sided document or printed page, it is possible to obtain by reflex copying methods, or direct contact printing, a high-contrast positive copy. Such a copy may then be used as a master original from which duplicate copies can be made by the much cheaper dyeline (diazotype) or blueprint process. Note particularly that if the drawing or page is to be reflex copied, which is necessary with a double-sided original, the copy will be laterally reversed and thus ready for duplication by any suitable process. " Duostat " paper is very much slower than normal contact reflex paper and for a copy of the 16 in. × 20 in. size exposure should be to four Photoflood lamps so placed as to give 15 to 20 secs. as the correct time. Alternatively, the plan-copying printer may be used to expose such paper since it is easy to adjust the machine to the required speed. An important advantage of " Duostat " paper is that the base is exceptionally thin and translucent.

Another useful application of normal document paper to plan-copying is in obtaining black line copies on a white background from blue prints without using the camera. Employing ordinary contact printing methods, small blue prints may be printed on reflex or ortho document paper using a yellow reflex screen or yellow safelight as the correcting filter. With ortho-line film and certain types of (translucent) film papers the use of such correcting filters in this way will give a rapid-printing negative from which subsequent dye-line prints or blue prints may be made.

OSCILLOGRAPH RECORDING

So far as they concern photography, oscillographs are of two distinct types. (1) Those in which the record is traced by an oscillating beam of light. (2) Those where the oscillating beam consists of cathode rays or electrons.

Representative of class 1 is the Duddell electro-magnetic type in which an oscillating mirror reflects a spot of light on to sensitive paper or film. The latter may be secured on to a rotating drum, in which case a trace of wave form will result if the beam of light striking the emulsion oscillates in a straight line at right angles to the line of rotation.

Cathode ray oscillographs are of two main types; the first embodies a sealed-off glass self-contained tube in which the electron beam sweeps a trace when focused on to a fluorescent screen formed on the inner surface of the flattened circular end of the tube. Improvements in the performance of such sealed-off tubes have greatly increased their usefulness, and photographic methods have also improved. Employing maximum aperture lenses, particularly the latest Wray f/1.0 copying lens specially designed for oscilloscopes using such tubes, extremely high speed transients are boldly recorded on special film stock such as Kodak R-60 panchromatic and Ilford 5R101 fast panchromatic recording films. In emergency, quite good results are obtained on normal rapid panchromatic miniature films. Standard widths of recording film are 16, 35, 60, 70, 120 and 300 millimetres, and the types mentioned are equally suitable for blue, green, or red fluorescent images.

Transients recorded by projection are of two distinct kinds. (1) Where a full wave appears on the screen for a brieftime and is photographed on to a stationary film. (2) Where the transient or wave appears on the screen as an oscillating line and is extended by projection on to a revolving film which provides the time base. Lissajous figures or standing waves which repeat themselves relatively unchanged may be given longer exposure which permits some stopping down of the lens. The simplest method of recording standing waves is by contact with film or paper placed on the end of the tube.

The second and more versatile type of cathode ray oscillograph is mechanically evacuated of its air, allowing the film to be introduced inside the instrument, in which case the electrons impinge directly on the film. In this way a sweeping impulse of brief time is more easily recorded, although much depends on the concentration of the electron beam. This type of instrument may also contain the film on a drum rotating in vacuo, in which case the record is also made directly on to the sensitive surface. As in the case of the Duddell type, the time base is provided by the precise speed of rotation, according to which the wave is more or less extended.

Sensitive Materials

Where the source of reflected light is carbon arc, a slow or medium speed film is quite satisfactory. For slow moving beams a process film may be used according to intensity, but in the majority of cases encountered fine-grain ordinary films are difficult to improve upon for recording the ordinary run of alternating current phenomena. Exceptionally thin film is undesirable, and that of 7/1,000th of an inch thick or more is most suitable. For photographing fluorescent patterns in sealed glass tubes, particularly green coloured traces, a medium speed contrasty panchromatic film is recommended, and the same material or a contrasty ortho grade may be used for light beams reflected from tungsten filament lamps. When the sensitive material is required to be paper, as sometimes is the case in certain electro-magnetic recordings, plain or ortho photomechanical or document paper may be used according to the intensity and colour of the light.

In certain types of mechanically evacuated cathode ray oscillographs, Schumann plates are occasionally used, but improvements in beam concentration and penetrating power have brought such records within the range of ordinary materials. The blackening of the film by electrons depends on the depth of penetration. It has been stated (Dr. A. B. Wood) that the penetration of cathode rays falls off rapidly with decreased voltage. Another peculiar feature of such rays is that emulsion sensitivity as we know it in relation to light does not apply to blackening by electrons. For this reason high-speed films are not generally so successful as those of the fine grain ordinary type. Medium speed ortho types of films are occasionally used for high speed single impulses of brief time, and for transients recorded on rapidly moving film or paper, but the possibility of fog masking traces of high writing speed must be considered.

Development

Maximum development of the trace without fog is essential and a quick developing non-stain formula is recommended. A good X-Ray developer such as Kodak D-19 or D-19b, or Ilford ID-33 Oscillograph Developer may be used for plates, films and record papers. Shrinkage of films is negligible and at any rate consistent if processing is carried out as quickly as possible with all baths at equal temperatures. When paper replaces film, however, some means of recording shrinkage should be available, since any alteration in the size of trace or wave may affect the evaluation of such records. An extra-hardening bath is advised, particularly when films are to be examined in a wet condition.

Duplicate Copies of Records

Paper copies of original oscillograms are frequently required for circulation. The printing paper should be of the high contrast photomechanical or document type, in which case any of the above developers may be used. Since shrinkage of such papers may be considerable, and is rarely consistent, a transparent scale should be attached to the film so that its inclusion in each copy print will indicate the exact amount of dimensional variation.

DOCUMENT COPYING

Applications.—These are principally (*a*) the preparation of duplicate sets of records that may be stored in an alternative place for use in case of damage to the originals, (*b*) the rapid and accurate duplication of complex documents, (*c*) the preparation of duplicates for storing in the smallest most compact form. (This latter applies to micro-copying in particular.)

PHOTOSTAT AND STATFILE

The **Photostat** system is a proprietary of Photostat Ltd., 1-2, Beech Street, London, E.C.1. The Photostat Machine is a self-contained instrument built around a common supporting pillar, embodying horizontal copyboard, to hold originals up to 40-in. × 50-in., a square bellows camera with 45 degree prism in front of the lens, capable of taking negatives up to 18-in. × 24-in., means of carrying sensitive paper material in rolls up to 350 ft., and processing apparatus immediately adjacent to the exposure point. The original paper negative, which can be read the right way round, can provide any number of positives by re-copying in the camera. Capital cost is somewhat high, but the process is rapid and running cost fairly low. Photostat Ltd. supply a range of orthochromatic and non-orthochromatic papers of different contrasts, weights and surfaces, and other manufacturers also supply suitable sensitive material.

The Statfile system is also a proprietary of Photostat, Ltd. The Statfile Recorder No. 2 is a complete copying camera assembly, consisting of a square bellows camera taking 4¾-in. × 6½-in. and 6½-in. × 8½-in. negatives, the camera supported on a carriage running on parallel steel rails rigidly connected to a vertical easel frame capable of taking originals up to 40-in. × 60-in. The glass fronted easel proper can be swung into a horizontal position for rapid placing of originals below the metal pressure plate. The easel is illuminated by fluorescent or tungsten lighting as part of the general assembly. The camera also incorporates a projection device, a 125-watt mercury discharge luminant which forms the projection unit positioned behind the negative back. The film negative material is handled either in double film holders or in a daylight loading roll-film holder with capacity for 280 exposures. An illuminated viewing desk with magnifier is also available, while enlarged prints can be made with the apparatus.

Photostat Ltd. supply negative film, and a range of suitable materials for the preparation of prints. These are of varying weights and surfaces and there are also sensitised tracing cloth and translucent document paper. Translucent and tracing cloth prints will yield excellent blue print and dyeline copies. Other manufacturers' materials can be used in the system.

CONTACT and REFLEX (Playertype) COPYING

Copies are the same size as the originals and in the form of paper negatives reversed left-to-right that cannot be read directly. Further same-sized prints are prepared from these. Most of the available material is non-colour sensitive and of very high contrast. Initial apparatus can be quite inexpensive, though more elaborate plant goes up to high prices. Running cost is somewhat higher than in the processes described above, but the method is more easily accessible to the newcomer as the absolutely essential equipment is less specialised and no lenses are involved.

Apparatus.—The typical equipment is a box containing exposing lamps, a top of plate glass and some form of pressure pad to hold the sensitive paper and document in close contact upon the glass surface. Yellow light is preferred as it increases contrast and reduces image scatter. The glass top itself may be a yellow filter or the light source may emit a narrow band of rays within the yellow portion of the spectrum. In more elaborate equipment the presser pad is of the vacuum type with accompanying hand or motor pump, and an exposure time switch may be built in. Roll holders for the negative paper are available.

Typical are the " Hubex," Ilford, Miles "Copycat," " Ruthurstat," " Rectophot," and Hunter-Penrose instruments.

The most suitable papers are thin-weight of homogeneous character coated with relatively slow, fine-grained, high contrast emulsion; but successful work can also be done with ordinary bromide paper.

The methods are not ideal for reproduction of continuous tone pictures, or for half-tone illustrations of finer screen than 133 lines to the inch. Originals on coloured paper or printed in coloured characters may present difficulties, though experience shows this trouble is not frequent. The Diazotype process can be used for Reflex copying. The paper is developed with ammonia fumes or with a solution containing ammonia, supplied by the makers of the paper. Diazotype material coated on cellulose can also be used, but is not at present available in this country.

Contact copying is confined to documents written or printed on one side of the paper only. The document is placed face upwards on the glass, the sensitive paper face downwards on top of it, pressure is applied and the exposure made. Further copies are made from the negative by placing it face upwards on the glass with the sensitive paper face downwards upon it. *Note.*—If the original is placed face downwards on the glass a negative can be secured that will read the right way round, but there will probably be loss of sharpness that will be further accentuated in copies from the negative.

Reflex copying can be used for documents with the printing or writing on one side only or on both sides of the paper.

The sensitive paper is first placed on the glass with the emulsion surface face *upwards.* The document to be copied is placed upon it face downwards. If the document has writing or printing on both sides you should then place upon it a sheet of black material, to avoid " ghost " images from the reverse side of the document. Now apply the pressure pad and make the exposure. This may be of the order of 4 seconds.

Development.—A concentrated M.Q. developer is recommended, e.g. Kodak D.154, or Ilford ID.36, or a hydroquinone-caustic solution may be used. Development and fixation are rapid. A refinement which has been suggested is to rinse the negatives in a weak solution of potassium metabisulphite immediately after development before fixing in an acid fixing bath. Further contrast can be obtained with Farmer's Reducer. Wash well.

MICRO-COPYING

Reduced size negatives are made from the original documents on to film in strip form, either 16 mm. or 35 mm. wide.

The typical 16 mm. instruments are " Recordak " Models Nos. 17 and 23, using panchromatic film coated on safety base, supplied in 200 ft. daylight-loading spools. The machines take documents up to a width of 8½-in. and 10½-in. respectively, and these are fed into the machine consecutively as rapidly as the operator can work. The number of documents recorded on 100 ft. of film depends on their individual length, but varies from nearly 2,000 to over 6,000. The records are examined in a self-contained illuminated viewer which shows an enlarged image on a translucent screen. Paper enlargements can be made from the 16-mm. negative. The machine is rented, not sold, and processing carried out by the suppliers.

A recent addition to this range of equipment is the " Recordak " Microfilmer Desk Model, a dual-purpose instrument combining camera and viewer for 16 mm. film. The camera has a standard reduction of 26 : 1 and is capable of photographing documents up to 12 × 14-in. A combined viewer enlarges the reduced images back to a readable size. This Desk Model is sold outright.

In 35 mm. two main image sizes are obtained on perforated film. These are 24-mm. × 36-mm. and 18-mm. × 24-mm. respectively. Unperforated 35-mm. film, allowing a correspondingly greater image size, is used in certain equipment such as the " Micro-File Recordak."

Typical instruments are the Watson Document Camera and the " Recordak " Micro-File Camera Model A.H.

This consists of a camera mounted on a column with a copyboard below, capable of taking originals up to 17 × 25½-in. The camera gives a reduction range of 18 : 1 to 8 : 1. Automatic shutter operation and film wind, together with photo-electric exposure meter and automatic focussing are special features. The equipment also incorporates a finder light (giving the copyboard area covered at the various reductions) and provides for the use of two alternative image sizes. The magazine has a capacity for 100 ft. of 35-mm. microfilm—800 full frames or 1,600 half frames can be recorded. A special bookholder is available as an accessory. Four " Photoflood " lamps are held at a fixed distance above the copyboard.

Work can, of course, be done with much simpler apparatus. The main essential is a lens that will give perfect definition free from distortion, and reasonably flat illumination right up to the corners of the negative. The Bureau of Standards, Washington, requires a resolution factor of 3,000 lines to the inch for document copying objectives. Enlarging apparatus should be capable of preserving this quality in the enlarged image.

The camera to which the lens is fitted should be capable of moving the film from frame to frame, and of being focused accurately on the copyboard. It should have a simple time shutter, a means of supporting the camera above the copyboard, and the necessary illumination.

Silent cine cameras have been used, but normally take only half-frame records. Certain colour cameras with a two-frame pull-down have been used for the larger sized records.

Additional refinements can be: series-parallel switching when using Photoflood lamps, to conserve the life of the lamps; foot-operated exposure control; a device which projects a light patch of the size and shape of the area which will be covered by the camera-taking lens, to facilitate placing of the documents; special holders for books and other thick originals to keep their surfaces in the plane of focus; extra wide copyboards to permit of the two halves of such originals as large ledgers being recorded in succession; some form of exposure recording device and an exposure time-switch. Many of these are incorporated in the commercial instrument already described.

Material.—Although ordinary 35 mm. "Positive" film can be used, special materials are to be preferred. High-resolution, high-contrast, fine-grain emulsions have been evolved, typical materials being :—

Ilford Micro-Neg Pan Film (Panchromatic).

Ilford Fine Grain Safety Positive Film.

Recordak Micro-File Pan.

Recordak Micro-File Fine Grain Print (Non-colour sensitive).

All the above are coated on safety base.

Lighting and Exposure.

Exposures for the commercial apparatus have been worked out and precise recommendations are available from the suppliers. The following recommendations have been made for improvised apparatus.

Kodak recommend, for two Photofloods at 45 degrees angle 3 feet from the document, ½ second at f/16 for Micro-File Pan. Apertures from f/8 to f/16 will give maximum sharpness and the former should rarely be exceeded. Pencil drawings on tracing paper are best illuminated from behind, a suitable diffusion plate supporting them.

Ilford recommend, for two Series I Photoflood lamps in reflectors 2 ft. from the centre of the copy, half a second at f/8 for Micro-Neg Pan.

A refinement fitted to some machines is a photo-electric cell light measuring meter that is swung out over the copyboard to read the light falling upon it. The light can be brought to a standard reading by moving the fittings or manipulating a resistance.

Exposure time varies with degree of reduction, because at any given diaphragm setting the intensity on the film varies inversely as the square of the camera extension. The following table, based on an exposure of 1 for infinity, gives relative exposures for reductions of from full scale to 1/20, but these figures may be subject to modification under practical conditions.

Ratio of reduction	Relative exposure
1 : 20	1.1
1 : 10	1.2
1 : 4	1.55
1 : 3	1.8
1 : 2	2.25
3 : 4	3
Same size	4

Degree of reduction.—The external size of the original is not the main determining factor. The maximum permissible reduction factor is conditioned by the size of the actual characters to be reduced and, to a lesser degree, by their form and colour. The sensitive material will also affect this aspect of the problem. A full page of the *Times* might be reduced to full-frame with greater facility than a quarto sized letter badly hand-written in pencil. Pencil notes on drawings offer many traps.

As a general factor, the recommendation of a general maximum reduction of 18 for commercial work is a sound one, although the factor for well printed matter on good paper can be much higher. These figures are based on well-substantiated theory that type should not be reduced in the micro-negative to a size below the equivalent of 0.4 points, one point being equal to 1/72 inch.

Filters.—Where possible it is preferable to use panchromatic negative as standard as generally better results are obtained. It is more sensitive to artificial light; variations in colour of the paper and of the characters upon them will, in most cases, be less noticeable, and where necessary, density and contrast can be controlled by the use of filters. The general principles to be observed are: a filter of opposite or contrasting colour to lettering and markings will increase its contrast from the background; a filter of a similar colour to that of the background paper will cause it to be rendered as light as possible. Stains can be depressed in a similar way; e.g. a yellow stain can be eliminated by using a yellow filter.

Negative quality.—The ideal negative, when laid on white paper, should show white or nearly white lettering and printing on a background of maximum density.

Processing.—As document copying film is normally used in rolls of 101 feet or more, development will most often be entrusted to a commercial service. Shorter lengths should, however, present no difficulty.

So-called fine-grain development is not considered necessary, the characteristics of the recommended emulsions already providing for fine-grain results.

M.Q. Developers, such as Ilford I.D.2, or Kodak D.158 have been recommended, and any good bromide paper developer is also suitable. An acetic acid stop bath is desirable, and an acid hardening fixing bath should be used. Wash thoroughly.

For final paper positives use a hard-working developer for line records, as given under Reflex Copying. For tone copies, e.g. from water-colour originals or photographs, use a softer working M.Q. formula.

Operating Note.—Owing to the considerable degree of reduction involved and the smallness of the resultant image, vibration of the copying instrument must be scrupulously avoided, as it is a potent cause of failure. It is also desirable that the operator should frequently check the accuracy of focus, as an unsharp result is useless.

ELECTRONIC FLASH TECHNIQUE

The following notes are compiled by J. Scales-Manners, Managing Director of Langham Photographic Instruments Ltd. The introduction is designed to put the newcomer to electronic flash on the right lines; the remainder presents, in as concise a form as possible, the latest data on technique in this rapidly developing sphere of photography,

General Considerations

The determination of exposure by the flash factor system is the only one which can be considered practical when using electronic flash. As is well known, this system is based on the relationship of the distance of the light to lens aperture. Each film is allocated a flash factor according to its speed to electronic flash.

For example, using a certain film/equipment combination it is found that with the light at a distance of 10 feet an aperture of f/22 is required to produce a suitable negative. We would then say that the film has a flash factor of 10×22 (220) to the equipment in use. From this figure, other distances and apertures can be calculated. For example, if the light is 20 feet away from the subject, then the aperture would be f/11. On the other hand—again supposing that the film has been giving a flash factor of 220—if one particularly wished to use f/8, the working distance would now be $220 \div 8$ or approximately 30 ft.

The recommendation of a flash factor for a particular film presupposes that a certain development technique will be adopted. This may not be a satisfactory one for the photographer's point of view so that the newcomer to electronic flash must make up his mind exactly how his instrument will be related to his normal negative technique.

There are three methods of approach. Firstly, the sublimating of electronic flash to the photographer's existing technique; secondly, to adopt a separate technique for electronic flash; or thirdly, devising a technique that is equally suitable for electronic flash and normal photography.

Before consideration can be given to any of these three techniques, it is as well to know some of the basic facts about the effect of electronic flash on the photographic emulsion.

The light is soft and negatives tend to be full of detail but lacking in contrast unless full or extra development is given. The degree of extra development, if any, which is required can only be determined by trial. Some manufacturers' films produce an excellent negative with normal development, whereas another may produce the same type of negative only after a development time increase of 100 per cent. No emulsion yet tested has produced a satisfactory negative at less than the maker's recommended processing time for normal subjects. It will be seen, therefore, that incorporating electronic flash successfully to existing technique depends upon (*a*) the film that is habitually used and (*b*) whether the full recommended developing time is given.

Many photographers, whether consciously or not, over-expose and under-develop. One cannot criticise this technique as some of the finest photographers in the world adopt it, but as under-development is taboo with electronic flash there can be nothing but disappointment if an attempt is made to fit electronic flash into such a technique.

Applying a special technique for electronic flash means that the best emulsion is chosen, and by that is meant the emulsion most suitable for electronic flash. This is coupled with a development procedure which makes the most of the speed of the film and at the same time gives a sufficiently fine grain negative for the purpose required.

The main disadvantage of this method is that if roll-film cameras are used, it is impracticable to cut out the exposures made with other forms of lighting to enable the negatives taken with electronic flash to be processed independently.

The third method of approach—adopting a technique equally suitable for electronic flash and normal photography—stands the best chance of success. It means that a film is chosen which has a good response to electronic flash with normal full development and is equally suitable for the other purposes for which the film will be used.

It may be thought that this ideal is not easily attained as there are subjects that are essentially contrasty in themselves demanding extra exposure for the shadows and a certain degree of under-development to produce an easily printable negative. As many electronic flash users will know, those subjects tend to become rarer due to the fact that, as the operating costs of electronic flash are practically nil, the equipment will often be used in combination with other light sources with the main purpose of reducing the inherent contrast of subjects of this kind.

Having then determined which of these three methods of approach will be adopted it is now necessary to arrive at a general purpose flash factor, with the emulsion and developer chosen. This can be done quite easily, by making a series of exposures under the conditions it is expected will be mostly encountered, and developing and analysing the results.

Before making the initial tests, it should be noted that there are some developers which are not so suitable as others for electronic flash negatives.

The most unsuitable are those which are normally very soft working and are generally characterised by a normal development time of around 20 minutes. Among those that have been consistently used with success are the fine-grain developers Unitol, ID-11 (or D. 76), and Promicrol, and Johnsons Universal and Press Contrast developers.

Estimating the Increased Development Required

It must always be borne in mind that when an emulsion manufacturer specifies a time and temperature for a certain material he has a definite contrast in mind. This may be, for example, a gamma of 0.8. At the same time, another manufacturer may quote a time and temperature recommendation which will produce a negative of gamma, say, 1.0, which he considers to be right for his material, so that one can only generalise when one says that the development of all electronic flash negatives should be increased by so much per cent.

A good way of conducting a test is to use 12 plates or pieces of film and expose them in three sets of four. Take three exposures at the same aperture and shutter speed, of a typical out-door subject, without flash. Then, with the equipment-maker's recommended flash factor, plus the information given above to guide you, make exposures at various flash factors at and below the one recommended by the manufacturer.

For instance, if the flash factor should be 220, make one exposure at that factor, another one at 160 and another one at 110. Make each exposure three times so that you will have in each set four negatives.

In most equipments the neon " ready to flash " indicator is set at 80 per cent. of the full output. By the time the operator has observed the neon, transferred his eye to the viewfinder, made a final check on his subject, the instrument should have reached its final output. During these initial tests, therefore, the exposure should be made at 4 seconds after the neon has commenced to glow.

Develop No. 1 set for the normal time in a suitable developer, as recommended above. It will be better to go by the developer manufacturer's time of development in this case, rather than the film maker's. The next batch of four could be processed for 20 per cent. longer than the first batch, and the third batch for 50 per cent. longer.

When the negatives are washed and dried, it will be easy to assess the set which gives the most satisfaction, and a note should be taken of the development increase necessary to produce a print on the grade of paper you are accustomed to using.

It is rather important to make actual prints from the negatives, especially those taken by electronic flash, because the appearance of an electronic flash negative can be deceptive to one unfamiliar with this type of lighting.

For the miniature camera user, where correct exposure and development is of even greater importance than to users of larger cameras, the description of a practical test with a commercial instrument with a rated flash factor of 150 to fast film will be of interest.

A camera was loaded with a fast pan 35-mm. film of fine enough grain to produce 10× enlargements without the grain becoming obtrusive. The equipment was used at home in average rooms 15 ft. × 12 ft. × 10 ft. high. All rooms had plain white ceilings and the walls were a medium yellow in colour. The lens aperture was fixed at f/16, and to make sure that only the flash recorded, the shutter speed of the synchronised Compur Rapid was set at 1/500th second.

A series of exposures was made under varying conditions and at distances of 12 ft.—6 ft. In some cases the camera was used separately and the flash-head screwed to a lighting stand. The angle was never more acute than 45 degrees. The subjects were the family and, of course, light and dark objects in the field of view. Some "stop action" pictures were taken with the camera 3 feet from a "Horlicks" mixer with the light 6 feet away and angled. As a final test the equipment was taken outside during the night and a black car, with someone sitting on the running-board, was photographed. The distance in this latter case was 20 feet and as there was no reflection whatsoever an aperture of f/4 was used.

The film was developed in G.206, the composition of which is :

Metol	2 gms.	42 grs.
Anhy. sodium sulphite	100 gms.	4 ozs.
Hydroquinone	4 gms.	80 grs.
Borax	2 gms.	40 grs.
Water to	1,000 c.c.	40 ozs.

This developer was used at 70° F. for 17 minutes (agitation every minute) and after completion of processing selected negatives were printed and the results analysed. No negative was under-exposed and all printed on normal or soft paper without difficulty. The face of the person sitting on the running-board of the car was over-exposed considerably but details inside the car could be picked out.

While all negatives made technically satisfying pictures, the user decided that, to suit his own personal preference, he would, in future, use a basic flash factor of 120 and develop for 14 minutes, providing the location for photography was similar.

A favourite subject is the photography of children in the bath. If a white tiled bathroom is the scene, the power of the equipment is supplemented by the high reflection of the walls and exposures should be reduced accordingly. As a complete contrast, pictures taken out-of-doors at night will require a factor of 80. Mid-way between these two extremes lie possibilities of oak-panelled rooms, tobacco smoke-filled rooms, small dance halls, etc. Remembering that over-exposure produced by electronic flash does not generally produce " clogged " highlights, it is better to be generous in one's estimate rather than risk disappointment.

Equipment

The most popular equipment of all is that with an output energy of 100 joules. There are two types available. The first is represented by high voltage and low capacity (2.7 kV and 28 mfd. capacity) and such an equipment weighs approximately 15 lb. The second and most recent type makes use of high capacity and low voltage (1 kV and 200 mfd.) and is identifiable by low weight of between 8 and 10 lb. and has a " hair-pin " type tube compared with the spiral type of tube of the former equipments.

Lower-powered equipments (15-22 joules) are now available. These make use of the relatively low operating voltage of 180 volts with a capacity of some 1,000 mfd. While their application is somewhat limited for professional use they are very useful for distance of up to 10 ft. with fast film or for the popular synchro-sun technique. The weight is low—3-4 lbs. but within the limitations given above are very practical equipments.

From a photographic point of view the low voltage equipment is better. The flash is longer—1/2,000th sec., compared with 1/5,000th sec.—and this means less reciprocity failure on certain film emulsions. The more compact light source enables the maximum amount of light to be reflected. Losses are inevitable with the extended spira type of tube. With the 180 volt equipment the flash is appreciably longer—1/800th second but due to the more compact light source reflector efficiency is more easily attained.

For our tests, however, we will bracket these first two types of instrument together, as the difference in exposure for most films is only ½ a stop at most.

For the average subject—let us assume this to be a furnished room not less than 16 ft. × 12 ft. with medium coloured walls. Include a fair proportion of dark coloured objects in the view—furniture with grained detail if possible.

Flash factors for 100-joule equipments

The following flash factors are based on 50 per cent. increase on manufacturers' recommended development times.

Films and Plates	Developer Group 1	Group 2	Group 3
Agfa ISS, Gevapan 33, HP3, Kodak P.1500, P.1200, Super-XX	110	160	220
Agfa Isopan, Gevapan 30, Ilford FP3, Kodak Plus-X, Verichrome, Ortho-X	80	110	160
Gevaert Microgran, Kodak Panatomic-X	56	80	160

Group 1.—Kodak DK.20, Microdol, Ilford ID-48, Agfa Atomal, Johnson Super Fine Grain.

Group 2.—Kodak D.76, D.23, Agfa 17, Ilford ID-11, Johnson Fine Grain and Universal, Kodak Universal.

Group 3.—Promicrol, Ergol and Capitol.

When equipments of other joule ratings are used, it should be noted that flash factors are proportional to the square root of the light output, i.e. if an equipment of 200 joules were used a flash factor of 160 becomes 220 and *not* 320.

If the reader is new to electronic flash and must produce an acceptable result from his first exposure, these factors can be considered reliable given in-date film and fresh developer.

Electronic flash as a fill-in to sunlight

Many photographers are using small portable equipments at the camera position for wedding groups and sports subjects to reduce contrasty back or side lighting. It is surprising how little light is required to make an acceptable picture with a crisp high-light in each eye and pleasant luminosity in the shadows. Overdone, this combination defies credulity. As Mortensen says: "The model's face seems to be lit up like a Japanese lantern. It appears to be not merely illuminated but to glow from within by some fiendish agency."

Electronic flash is particularly easy to use as a fill-in light especially with inter-lens shutters. Referring to initial experiments you will know the flash factor to be used when *normal* development must be adopted. Suppose this to be 110. Take a meter reading of the background. This could be a 1/200th at f/11. If the subject distance is 10 ft. it will be seen that an exposure of 1/200th at f/11 will give a balanced negative but slightly over "filled-in". If the aperture is reduced to f/16 and the shutter speed lengthened to 1/100th, the background will still be correctly exposed but the fill-in flash will have been reduced sufficiently to produce a perfectly natural and pleasing result. As an aid to memory—shutter speed for the background and aperture for the flash.

In cameras using focal-plane shutters this practice cannot be adopted due to the necessity of using fixed speeds. One must resort to using the flash away from the camera to combine flash-factor with existing light. A much simpler way is to cut three strips of paper of varying thickness, i.e. tissue, typewriter copy paper, writing paper—each to be formed into a cylinder which will fit over the flash-tube. Secure the edges with Cellophane tape. Determine the flash-factor for the equipment with each of these tubes in position and make a note on each cylinder for reference. This method of light limitation can be very useful where the lens apertures are limited (as in miniature cameras where f/22 is usually the smallest stop) and the subject is close.

Colour photography with electronic flash

Colour emulsions respond particularly well to electronic flash. The motion picture industry—pioneers of many of today's recognised techniques—have long recognised this and at least two major studios in England are equipped with units of 3,000 joules in order to produce 10 × 8-in. colour transparencies of " stills ".

The advantages of electronic flash are that the light is very nearly the same colour temperature as daylight, and is cool in operation; that operating costs are fantastically small; that the light is constant throughout the tube life; and that subject movement is conquered. With the rise in popularity of the colour negative-positive process (Agfa, Gevaert, Pakolor, Ektacolor, Kodacolor, etc.) there may come a time when electronic flash will be considered the standard illuminant for use in the colour studio.

Flash factors

For first-quality results an experiment with each batch is necessary. The coating of colour emulsions is far more complicated than for monochrome, and whatever the illuminant used, exposure and filter should be determined for each batch used. In all cases the daylight emulsions of each manufacturer should be used to obtain maximum speed with very light filtering.

Kodak Colour Films

Daylight Ektachrome and Daylight Kodachrome respond very well to electronic flash. With Kodachrome an 81B filter has been found to give most satisfaction on both English and American coated stock with a factor of 20 for 100 joules. The filter recommended for use with Ektachrome is stamped on each instruction sheet enclosed in the box and can vary—sometimes being none at all, sometimes CC-05M (magenta) or CC-10Y (yellow). Ektachrome would appear to be slightly faster than Kodachrome to electronic flash and a factor of 25 would make a good starting point.

Filter recommendations are supplied with each box of Kodacolor and Ektacolor. The latter is balanced for tungsten light only.

Ilford Colour Film and Ferraniacolor

This should be used with a " Q " (ultra-violet) filter with a factor of 22 for an outfit working at 100 joules.

Negative-positive processes

The British and Continental makes of this type of film have approximately the same speed and, by nature of the printing process, slight over-exposure can be easily accommodated. A flash factor of 20 can be used with confidence with no filter.

Finally, it must always be remembered that colour is an extremely personal appreciation. To one, a transparency will appear a little "cold", to another the same transparency may appear correct or even "warm". Electronic flash gives good colour easily as it frees the photographer from all worries of fluctuating colour temperatures in tungsten lamps through ageing or voltage drop on the mains supplies. Once a flash factor and filter is approved, technically good results are assured throughout the batch.

RECIPROCITY FAILURE

The reciprocity law of Bunsen and Roscoe states that the product of a photochemical reaction is proportional to the total energy involved. In photographic terms this means that for a given density the product of light intensity and exposure time is constant. For photographic emulsions this is true only over a comparatively narrow range, and the effect of its breakdown is that for very high and very low light intensities (i.e. very long or very short exposures) a longer exposure has to be given than would follow from the reciprocity law.

The tables below, showing the corrections required, are taken from an article by E. G. Wallis and A. A. G. Beatt, published in the I.B.P. Record (1951, **30**, 236-8), to which the reader is referred for a very useful summary of the rather complicated practical considerations that result from reciprocity failure. Based on Halm's Catenary Equation, they have been proved by prolonged practice and experience with a variety of emulsions, and enable corrections to be made for the average emulsion: they may not suit all, but even so their use should give results far better than if no correction had been applied.

Table C gives some guidance in the use of filters to correct the effects of reciprocity failure on colour balance.

Table A gives, for average negative emulsions, in the first column, the exposure indicated by meter or otherwise, without correction for reciprocity failure. The second column shows the exposure which should be given to allow for such failure. Table B gives corresponding corrections for reversal emulsions, less correction being required because in these the greater densities near the shoulder of the curve, and not the toe, are primarily involved. Table C is designed to assist in correcting colour imbalance in integral colour materials due to differences in reciprocity failure between the respective colour layers of the pack. It relates to a typical batch of Ektachrome, but is only given as a basis for experiment, as different batches of material may behave in quite different ways. To use the Table, the exposure is determined in the usual way and corrected for reciprocity failure, as already described, by means of Table B. The exposure value thus found is then located in column 1 of Table C. Add the filters indicated in column 2 and multiply the exposure by the factor in column 3. The reader is referred to the original article for a concise explanation of underlying principles as they affect colour balance, use of flash, effect of temperature, of development, and of materials. Tables A and B are somewhat abbreviated by the omission of some of the exposures given in the original article, but as a possible added convenience to the user, a third column has been added in which appears the percentage exposure increase at each exposure level as derived from a mean curve plotted from the authors' values.

TABLE A (For non-reversal materials)

Indicated exposure	Corrected exposure	Percentage increase	Indicated exposure	Corrected exposure	Percentage increase
secs.	secs.		secs.	secs.	
1/5000	1/1530	230	3	$4\frac{2}{3}$	55
1/250	1/930	170	4	$6\frac{1}{2}$	63
1/1000	1/470	113	5	$8\frac{3}{4}$	75
1/500	1/280	80	6	11	83
1/300	1/210	60	8	16	100
1/200	1/140	43	10	22	120
1/150	1/110	38	15	35	133
1/100	1/80	25	20	50	150
				min. sec.	
1/50	1/45	10	30	1 25	183
1/30 to 1/3	no correction		40	2 4	210
			min.		
			1	2 29	250
			$1\frac{1}{2}$	5 50	265
2/5	3/7	7	2	8 33	325
2/3	3/4	12	3	14 31	385
1	$1\frac{1}{4}$	25	4	20 45	420
$1\frac{1}{2}$	2	33	5	27 30	550
2	$2\frac{3}{4}$	38	10	68 22	680

TABLE B (For reversal and reversal colour materials)

Indicated exposure	Corrected exposure	Percentage increase	Indicated exposure	Corrected exposure	Percentage increase
secs.	secs.		secs.	secs.	
1/150	1/120	25	3	4	40
1/100	1/85	20	4	$5\frac{3}{4}$	45
1/80	1/70	15	5	$7\frac{1}{2}$	50
1/60	1/55	10	6	$9\frac{1}{2}$	60
1/30 to 1/2	no correction		8	13	66
			10	17	75
			12	22	80
2/3	3/4	15	15	29	90
1	$1\frac{1}{6}$	20	20	40	100
$1\frac{1}{2}$	2	30	25	54	115
2	$2\frac{1}{2}$	33	30	68	125

TABLE C

1	2	3
$\frac{1}{3}$ to 1	One CC-05M	1
1 to 3	One CC-10M	$1\frac{1}{4}$
3 to 10	One CC-20M and one CC-10Y	$1\frac{1}{2}$
10 to 30	Two CC-20M and one CC-10Y	2

NARROW GAUGE CINEMATOGRAPHY

Sizes and Types of Black-and-White Film

Overall Width	Type		B.S. (A.S.A.) Exposure Index†	
			Daylight	Tungsten
8 mm.	Reversal	Agfa Isopan F	25°	—
		Bauchet Super Pan Anti-Halo ...	25°	—
		Ferrania Panchro Reversal CSS-32...	31°	—
		Ferrania Panchro Reversal 28 ...	27°	—
		Gevapan 23 Micro	22°	20°
		Gevapan 26 Super	25°	23°
		Gevapan 32 Ultra	31°	29°
		Cine-Kodak Eight Super-X Panchromatic	27°	26°
		Cine-Kodak Eight Panchromatic ...	21°	20°
		Perutz (2×8) Rectepan 15	15°	—
		Perutz (2×8) Rectepan 21	21°	—
	Positive	Gevaert Positive Super Contrast ...	—	—
9.5 mm.	Reversal	Bauchet Super Pan Anti-Halo ...	25°	—
		Ferrania Panchro Reversal CSS-32...	31°	—
		Ferrania Panchro Reversal 28 ...	27°	—
		Gevapan 23 Micro	22°	20°
		Gevapan 26 Super	25°	23°
		Gevapan 32 Ultra	31°	29°
		Pathe SS Panchromatic	23°	21°
		Pathe VF Panchromatic	32°	30°
	Negative	Ferrania Super Panchro Negative S2-32	31°	—
	Positive	Gevaert Positive Super Contrast ...	—	—
16 mm.	Reversal	Bauchet Super Pan Anti-Halo ...	26°	—
		Ferrania Panchro Reversal CSS-32...	31°	—
		Ferrania Panchro Reversal 28 ...	27°	—
		Gevapan 23 Micro	22°	20°
		Gevapan 26 Super	25°	23°
		Gevapan 32 Ultra	31°	29°
		Cine-Kodak Super-XX Panchromatic	31°	29°
		Cine-Kodak Super-X	27°	26°
		Perutz Rectepan 21	21°	—
	Negative	Ferrania Super Panchro Negative S2-32	31°	—
		Gevapan 27	26°	24°
		Gevapan 33	32°	31°
		Ilford Pan F	23°	21°
		Ilford HP3	32°	31°
		Kodak Plus-X Negative	30°	28°
		Kodak R.55 Recording	—	29°
		Perutz Perkine 16	17°	—
	Positive	Gevaert Positive Super Contrast ...	—	—
		Ilford Fine Grain Safety Positive ...	—	—
		Kodak Positive Safety	—	—
		Perutz Positive	—	—

† The British Standard Method of Determining Speed and Exposure Index (B.S.1380) does not provide for the measurement of speed of reversal film. The B.S. Exposure Tables do, however, provide for the use of an exposure index for these materials. Accordingly, the speeds quoted above are based on information supplied by the manufacturers as suitable for use with these tables or with meters calibrated in B.S. Exposure Indices. For approximate conversion to other speed number systems see Table on page 422.

PROCESSING.—Reversal System

Certain makes of reversal film are sold only at a price which includes processing by the manufacturer. Processing formulæ are not issued. The formulæ printed are those issued by manufacturers for their own materials, but in most cases are also suitable for other makes of film, although slight modifications may prove necessary.

BAUCHET

Recommended for the processing of Bauchet Super Panchro Reversal Anti-Halo Film.

NOTE: First development, first washing and reversal should be carried out by green safelight.

First Development.

Solution 1.	Sodium sulphite (anhydrous)	50 gms.
	Hydroquinone	15 gms.
	Sodium carbonate (anhydrous) ...	10 gms.
	Potassium bromide	8 gms.
	Water at 68–86°F. to	950 c.c.s.
Solution 2.	Caustic soda	10 gms.
	Water to	50 c.c.s.

Mix the two solutions *just before use.*

Develop at 65 to 70°F. Time of picture appearance determines duration of development; between 4 and 14 minutes. For instance, for a time of appearance of 25 seconds, develop for 5 minutes, for 35 seconds develop 9 minutes. If film is under-exposed, it is better to resort to reduction than to prolong development.

Washing.	At least 5 minutes in running water at 65°F.	
Bleaching.	Potassium bichromate	6 gms.
	Sulphuric acid, pure	10 gms.
	Water to	1 litre

Bleaching should take from 3 to 5 minutes in this solution.

Washing.	5 minutes in running water at 65°F.	
Clearing.	Sodium sulphite (anhydrous) ...	100 gms.
	Water at 65°F. to	1 litre

Operation should be complete in approximately 3 minutes.

Washing.	3 to 4 minutes in running water at 65°F.
Exposure.	Expose to a 75-watt lamp at a distance of 5 feet for 1 minute.

Second Development.

Metol	2 gms.
Sodium sulphite (anhydrous) ...	30 gms.
Hydroquinone	6 gms.
Sodium carbonate (anhydrous) ...	25 gms.
Potassium bromide	2 gms.
Water to	1 litre

Develop to finality.

Washing.	Some minutes in running water.	
Fixing.	Hypo	200 gms.
	Sodium bisulphite	30 c.c.s.
	Water	1 litre
Washing.	Final washing should be thorough; allow 30 minutes.	

NOTE: As the anti-halo backing is only cleared in the bleaching bath this film should not be used as a negative.

PATHESCOPE LTD.

Recommended for development of Pathe Panchromatic Anti-Halo Direct Reversal film. Dissolve chemicals in order given.

NOTE: First development, first washing and reversal should be carried out by green safelight only, although the manufacturer recommends an inspection method of first development.

First Development.

Sodium sulphite (anhydrous) ...	70 gms.
Hydroquinone	10 gms.
Sodium carbonate (anhydrous) ...	35 gms.
Potassium bromide	8 gms.
Potassium sulphocyanide	3 gms.
Caustic soda	5 gms.
or	
Soda lye at 36° Baumé	12 c.c.s.
Water	1 litre

Dissolve chemicals in half above quantity of warm water. Complete with cold water and when temperature measures 65°F. add soda. Develop at 67°F. Constant time development is not recommended. Manufacturer states that time of picture appearance determines duration of development, between 3 and 15 minutes. If appearance is rapid, develop for short time; if slow, develop for longer time.

Washing. 8 minutes in running water at 65°F.

Reversal	Potassium bichromate	10 gms.
	Sulphuric acid at 66° Baumé ...	10 c.c.s.
	Water	1 litre

Dissolve bichromate, then *slowly* add sulphuric acid. Treat film until black negative image disappears.

NOTE: From this point onwards operations may be continued in weak white light.

Washing. Wash until all yellow tint disappears—between 10 and 15 minutes.

Whitening.	Sodium sulphite (anhydrous) ...	50 gms.
	Water	1 litre

Immerse film in this solution for 5 minutes.

Exposure. Expose film to ambient light, taking care to ensure it reaches the whole of the film.

Blackening.	Sodium sulphite (anhydrous) ...	30 gms.
	Metol	2 gms.
	Hydroquinone	5 gms.
	Sodium carbonate (anhydrous) ...	30 gms.
	Potassium bromide	2 gms.
	Caustic soda	2 gms.
	or	
	Soda lye at 36° Baumé	5 c.c.s.
	Water	1 litre

Develop to finality—time approximately 3 minutes.

Washing. 5 minutes in running water.

Fixing.	Hypo	200 gms.
	Sodium bisulphite (liquid) at 35° Baumé	30 c.c.s.
	Chrome alum	5 gms.
	Water	1 litre

Immerse film in solution for 3 or 4 minutes.

Washing. Final washing, 10 minutes in running water.

NOTES: The first development bath now recommended is quicker in its action than that previously given by the manufacturer. The anti-halo layer of the new Pathé film will dissolve only in the reversal bath. The material cannot therefore be finished as a negative only.

PROCESSING.—Negative and Positive

Negative Developing.

Medium fine-grain developers of the M.Q. Borax type are recommended. Here is a typical one.

Metol	1 gm.
Sodium sulphite (cryst.)	100 gms.
Hydroquinone	2.5 gms.
Borax	1 gm.
Water, to	500 c.c.s.

Develop for 10 minutes at 65° F. Fix in normal acid fixing bath and wash in usual way.

Positive Developing.

A typical developer is given below.

Metol	3 gms.
Sodium sulphite (cryst.)	100 gms.
Hydroquinone	12.5 gms.
Sodium carbonate (cryst.)	187.5 gms.
Potassium bromide	0.75 gms.
Water, to	2 litres

For use dilute 1 part with 3 parts water. Develop for 4 minutes at 65° F. Fix in normal acid fixing bath and wash in usual way.

AFTER TREATMENT

Reduction

Reduction can be carried out on either reversal or negative-positive material. Use Farmer's Reducer, either in normal mixture of potassium ferricyanide and hypo, which will increase contrast, or in potassium ferricyanide first and hypo afterwards, which will give proportional reduction.

Intensification.

Normal intensification methods are not entirely satisfactory with negative materials owing to the increase in grain size. Several toning methods will give increased printing density.

The following intensifier has been recommended for reversal positive:

Potassium bichromate	30 grains
Hydrochloric acid	35 minims
Water	35 ounces

Immerse film in bath for 4-5 minutes until the image has turned yellowish-white. Wash until colourless. Re-develop in normal developer. Wash for 5 minutes and then dry. The image tends to be warm in colour, and will not quite match with material that has not been intensified. This can be overcome by using a dupe from the whole film for projection purposes.

Film Cleaning

Pure industrial spirit plus 10 per cent of water can be used on a moistened pad for ordinary surface cleaning.

To remove greasy finger marks and dirt prepare:

Ethyl alcohol	85 parts
Methyl alcohol	10 parts
Ammonia 0.880	5 parts

NOTE: Methylated spirits can NOT be used as a substitute for the ethyl alcohol.

Pass the film through a folded chamois or linen pad moistened with the solution and held between the fingers.

A very dirty film or one which tends to be brittle can be treated by a 10 minute immersion in:

Acetic acid	1 part
Vaseline	5 parts
Carbon tetrachloride	100 parts

After immersion, gently polish with a chamois or soft linen pad.

It should be remembered that all spirit preparations tend to be solvents of the plasticisers in the film base and should not be employed excessively.

CAMERA NOTES

Camera Lens Angle.

To find approximately the angle covered by a cine lens of given focal length, a diagram may be prepared. Using suitable units of measurement describe a line representing the width across the picture aperture in the camera, and at its centre erect a perpendicular representing the focal length of the lens. Join the extremity of the perpendicular with the two ends of the base-line to form a triangle, extending the sides and the perpendicular to any convenient length. To find the width of scene covered by the lens at any given position plot the lens-camera distance along the perpendicular, measuring in suitable units from the apex of the angle. A line at right angles to the perpendicular at the point plotted will give the width, in similar units, of the scene covered at the distance measured. The shorter dimensions representing the height of the film camera frame can also be plotted on the same base line, and extended in similar fashion to provide information as to the height of the scene covered at any preferred camera distance.

Narrow Gauge Film Camera Gate Apertures

8 mm. film ...	4.80 mm. × 3.51 mm.
9.5 mm. film	8.5 mm. × 6.5 mm.
16 mm. film	10.41 mm. × 7.47 mm.

These are the sizes of image imprinted upon the films. In all cases the projector apertures are very slightly smaller.

Depth.

For depth table for amateur cine cameras see page 441.

Exposure Times.

Exposure times vary with the width of the shutter opening and, in different makes of camera, operating at 16 frames per second, the exposure times range from 1/28th second to 1/30th second. Exposure times vary proportionately with variations in the speed of the camera. Assuming a figure of 1/32 second at 16 frames per second, the relative times are as follows:

Frames per second	8	16	24	32	64
Exposure time ...	1/16	1/32	1/48	1/64	1/128

NOTE: 24 frames per second is sound film speed.

ARTIFICIAL LIGHT

Photoflood lamps are recommended for all but studio work. They consume less current and, burning at higher electrical pressure, their actinic value is much higher than that of lamps of normal loading. Their life is short when burned continuously. They are most likely to break down at the moment of switching on, because of current surge.

Life can be prolonged by a switching system so arranged that two lamps burn in series, and at lower individual pressure, during the setting-up period, being switched to burn in parallel at full intensity for the period of exposure only. The characteristics of the two Photoflood types are as follows:

275 watt Photoflood. Equivalent to 750 watt lamp. Life 2 hours.
500 watt Type N Photoflood. Equivalent 1,500 watt lamp. Life 6 hours.

Exposure Table for 275 watt Photoflood Lamps in Reflectors. For film of 29° B.S.I. to Tungsten Light

Aperture	f/1.9	f/2.8	f/3.5	f/4	f/5.6	f/8
No. of Lamps and distance from Subject	1 at 18ft. 2 at 26ft. 3 at 32ft. 4 at 38ft.	1 at 12½ft. 2 at 18ft. 3 at 22ft. 4 at 24ft.	1 at 10ft. 2 at 14ft. 3 at 17ft. 4 at 20ft.	1 at 8½ft. 2 at 12½ft. 3 at 15ft. 4 at 17½ft.	1 at 6ft. 2 at 8½ft. 3 at 10½ft. 4 at 12½ft.	1 at 4ft. 2 at 6ft. 3 at 7½ft. 4 at 8ft.

NOTE: These figures are exposures at 16 frames per second on medium toned subjects. Halve the illumination for very light subjects, double for dark ones.

Modify the figures in accordance with the speed factors given in the chart on page 422. All figures arrived at should further be increased by 50 per cent. when exposing at sound speed of 24 frames per second. It should also be remembered that the angle of the lighting relative to the camera, will also affect the value. The above table can only be regarded as a general basis for calculation.

TITLING

The following chart gives recommended distances for different sizes of title original allowing a slight margin for error in setting up. Columns 3, 5 and 6 refer to standard title card sizes, column 4 to half-plate photographs which may be used as backgrounds for titles. Distances are measured between lens front and card.

Title Card Distances

Type	Focal length	Size of Title Card			
		8½″ × 6½″	5¾″ × 4¼″	4″ × 3″	3″ × 2¼″
8 mm. film	12.5 mm,	22″	15″	10¼″	7¾″
,, ,,	13 mm.	23″	15⅝″	10⅞″	8⅛″
9.5 ,, ,,	20 mm. (¾″)	20″	13½″	9½″	7″
,, ,,	23 mm.	23″	15⅝″	10⅞″	8⅛″
,, ,,	25 mm. (1″)	25″	16⅞″	11¾″	8¾″
,, ,,	27 mm.	27″	18¼″	12¾″	9½″
16 ,, ,,	20 mm.	17″	11½″	8″	6″
,, ,,	25 mm. (1″)	21¼″	14⅜″	10″	7½″

Titling Exposures

The following table is based on figures given by H. B. Abbott in "Amateur Cine World."

Lights	Film Stock	
	Normal speed pan	Positive
A	f/3.5	f/2
B	f/2.8	f/1.5
C	f/5.6	f/4
D	f/8	f/5.6
E	f/5.6	f/2.8

A—2 × 100 watt lamps (pearl) in reflectors 8 in. from card.
B—2 × 100 watt lamps (pearl) in reflectors 14 in. from card.
C—1 × 275 watt Photoflood in reflector 12 in. from card.
D—2 × 275 watt Photofloods in reflectors 12 in. from card.
E—1 × 200 watt Nitraphot K or 1 × 500 Nitraphot 12 in. from card.

PROJECTION

Widths of picture obtained at varying distances with different lenses on 16 mm. and 8 mm. Projectors.

Lenses 16 mm.	1″	2″	3″	4″
Lenses 8 mm.	½″	1″	1½″	
Distances				
10ft. ...	3′ 9″	1′ 10″	1′ 3″	11″
20ft. ...	7′ 6″	3′ 10″	2′ 6″	1′ 10″
30ft. ...	11′ 6″	5′ 8″	3′ 8″	2′ 10″
40ft. ...	15′	7′ 6″	5′	3′ 10″
50ft. ...	18′ 8″	9′ 4″	6′ 4″	4′ 8″
75ft. ...	—	14′ 2″	9′ 6″	7′ 2″
100ft. ...	—	—	12′ 8″	9′ 6″

NOTE: A lens of given focal length will give a picture of twice the linear dimensions at twice the projection distance. A lens of twice the focal length will give a picture of half the linear dimensions at the same projection distance.

SCREENS

The characteristics of the three types of surface are:

White.—Best reproduction of general picture quality without increase of contrast and grain. Good light distribution in all directions, but lowest peak reflection factor. Best used for wide audiences when there is plenty of projection light available.

Silver.—Tends to increase contrast and show grain; high peak reflection back towards projector, but falls off somewhat rapidly at sides. Excellent for long narrow audiences and less projection light.

Bead.—Similar characteristics to "silver" screen, but higher peak reflection in best types. Somewhat less falling off to side but cut-off of intensity fairly sharp. This type most susceptible to damage, and deteriorates with age, especially if kept rolled for long periods.

USEFUL SUGGESTIONS

Waxing Solution

116 ozs. Benzene.
114 ozs. Carbon tetrochloride.
2½ ozs. hard paraffin wax with 130° F. melting point.

Mix thoroughly until clear, white and free from sedimentation.

Film Preservative (or " Humidifying" solution)

Glycerol	1½ ozs.	Oil of eucalyptus ...	1 oz.
Distilled water ...	7 ozs.	Oil of gaultheria (Wintergreen) ...	¼ oz
Camphor	1 oz.	Oil of thyme	¼ oz.
Menthol	½ oz.	Oil of baptisia	¼ oz.
Ethyl alcohol or other spirit	2 ozs.	Oil of mint (garden mint or peppermint)	¼ oz.

Add the glycerol to the distilled water and thoroughly mix to make Solution A. Dissolve camphor and menthol in the spirit to make Solution B. Mix the oils together and add to B. Add B to A. Shake well before using. A few drops on the pad of a 400-ft. humidor can is adequate. Store the film in a cool place.

Film Cement

The formula required varies with the make of film, but the basic ingredients are acetone, amyl acetate and, in some cases, acetic acid. An emergency cement may be made by dissolving small pieces of cellulose acetate (safety) film in alcohol or acetone, and the two latter fluids may be used to dilute a supply of cement which has thickened due to evaporation of the solvent.

CINE FILM IN THE TROPICS

The great danger is heat combined with humidity. Dry heat is less dangerous, although film sent by air may rapidly lose its sensitivity if it remains in a 'plane standing on the 'drome in full tropical sun and thus becomes subjected to considerable heat.

The preferred form of packing for raw stock is to seal not more than two 100-ft. spools in an airtight metal can, packing the whole consignment in a wooden box with plenty of heat insulating material, such as wood wool or newspaper.

If film is stored in a cool place the material for use should be brought up to the ambient temperature before unsealing, to avoid the possibility of excessive condensation in humid conditions. It is suggested in some quarters that, rather than resort to cold storage, it is better to keep the material in an incubator at a temperature sufficient to raise it above the dew point.

It is preferable to arrange for small but frequent supplies to be sent out, rather than attempt to store any large quantity. Deterioration can set in in a month or so under some conditions.

After exposure, film should be processed as soon as possible. Film exposed and kept in the tropics may suffer partial loss of latent image, growth of latent image, and/or fogging.

After exposure film should not be put back into hermetically sealed containers, as this prevents the moisture it has picked up during use from escaping; the ordinary container enables it to breathe. The film can be returned to its ordinary carton and then wrapped lavishly in absorbent and heat-insulating material such as newspaper. The most elaborate but most satisfactory method of storage during work is to prepare a large wooden container, large enough to hold, say, six 100-ft. rolls, and with two additional compartments, each with a container of an absorbent such as silica gel. One of the absorbent containers should be sealed. When the unsealed one is fully saturated, it can be removed, while the second one is unsealed to carry on the work. The first one is regenerated by desiccating in an oven or by whatever other method may be convenient. On no account must the absorbent material be allowed in direct contact with the film.

When travelling, film can most conveniently be kept among the clothes in one's trunk. The heated wardrobes on ships and in some tropical residences are excellent storage places.

Film for transit to the processing station should be packed during the coolest and least humid part of the day, so that it starts its journey with the minimum moisture content.

FILM IN COLD COUNTRIES

The greatest dangers here are brittleness of the base and static electricity. If film is unduly handled, or if the camera imparts too much friction to it, it will become heavily charged. The discharges will appear as tree-like markings over the picture area.

THREE-COLOUR PHOTOGRAPHY

The materials for colour photography can be divided conveniently into three groups: 1. Those which give a positive transparency either directly or indirectly. 2. Materials for making colour prints on paper. 3. Camera materials which are processed to a colour negative and are designed to be used with an associated print material.

The processes which follow are dealt with in the above order, alphabetically.

Most, or all, of the processes can be used in several ways depending on the type of final positive which is required. Those materials which give a positive transparency can be considered complete systems in themselves and the transparency viewed by projection or over an illuminated viewing box. Alternatively separation negatives may be made from the transparency and paper prints made from these using some of the processes in group 2. It should be noted that there is a limit to the maximum size of paper print which can be made from those materials in group 1 which employ a reseau, since over a certain degree of enlargement the reseau becomes visible, or, if steps are taken to eliminate it, definition is impaired.

The processes which give a colour negative are generally used only to give a print on the appropriate sensitive paper which is coated with three colour forming emulsion layers. In two cases however a transparency print material is available and both enlarged or same size diapositives may be made for projection or viewing by transmitted light.

TRANSPARENCY PROCESSES

Agfacolor Reversal

(Agfa Ltd., Deer Park Road, Wimbledon Factory Estate, London, S.W.19)

Agfacolor Reversal film is an integral tripack material which with suitable processing gives colour positives which may be viewed in a projector or over a light box. The film is used in the camera in precisely the same fashion as black and white film and when the film has been exposed completely it must be rewound into the original cassette. The film is available in the form of 20 and 36 exp. cassettes of 35 mm. film for miniature cameras and 12 exposure cassettes of the pattern used in the Agfa Karat camera. The film is frame numbered and bears the identifying coding " Agfacolor L UT " printed outside the perforations.

Agfacolor Reversal film is not intended for the production of colour prints on paper; for this purpose Agfacolor Negative film should be used (see p. 398).

EXPOSURE

Only one type of Agfacolor Reversal film is at present available, sensitised for use in daylight. The speed of the film is 25° B.S. Log. or 25 B.S. and A.S.A. Arith. The manufacturers recommend that ratings of 25° Scheiner or Weston 16 should be used with meters scaled in these systems. Filters are generally unnecessary and undesirable when using Agfacolor film but in a few exceptional cases when the spectral distribution of the illumination does not match the sensitivity of the film one of two filters may be used. To reduce the ultra-violet, which records as excess blue in high mountains, snow and at the seaside, the Agfa K29C filter may be used. This filter is colourless and has a factor of 1.3-1.5. When it is desired to use Agfacolor Reversal film with daylight sensitivity in photoflood illumination the K69 filter may be used. This filter is blue-violet in colour and has a factor of 5.

PROCESSING

The purchase price of Agfacolor Reversal film includes processing charges since processing kits are not available nor are the official Agfa formulæ published. The exposed film should be sent in the original cassette in which it was supplied to Agfa Ltd. at the address given above. For those photographers who wish to have their films processed whilst in continental Europe there are official processing stations in Germany, Holland, Denmark and Switzerland.

For those photographers who wish to attempt their own processing substitute processing formulæ and timings which have proved very satisfactory in practice have been published in the *British Journal of Photography* for 7th August, 1953. These details are abstracted in the " Epitome of Progress " section of this *Almanac*.

SEPARATION NEGATIVES

Separation negatives may be made from Agfacolor Reversal transparencies using the same technique and filters recommended for other processes of the integral tripack reversal type.

Dufaycolor

(Dufay Limited, 14 Cockspur Street, London, S.W.1)

Dufaycolor is an additive mosaic-filter process in which the reseau is printed on the film base mechanically before it is coated with a single black and white type reversal emulsion. The film is loaded into the camera with the base facing the lens so that the image formed on the emulsion is broken up into a regular mosaic of microscopic areas which are exposed or not depending on the colour of the subject at any one point. After reversal processing these areas of developed silver mask the filter areas which are of complementary colour to the original, leaving the remainder to reproduce the correct hues of the objects.

Dufaycolor film is available in three types. All types are coated on safety film base.

Type D.1.—Used for roll film and 35 mm. film for miniature cameras.

Type D.2.—Cut film of normal contrast.

Type D.4.—Process Film, Medium. Has appreciably higher contrast than Types D.1 and D.2. Available as cut film.

The normal contrast material should be used for portraits and general studio work, but there may be some subjects in the studio which require a slightly greater contrast, and for these the Process Film, Medium, may be used.

All three types of Dufaycolor film require filters for different light sources which have been determined for each batch. If a filter is required for any specified source, the batch number should be quoted when ordering, otherwise the filter supplied will be a compromise and the manufacturers cannot guarantee results equal to those obtainable with the correct batch filter. The code for ordering filters is given in the table below.

LIGHT SOURCE AND FILTER CODE

Code	Light Source	Colour Temperature
1	Daylight	5,500°K.—6,000°K.
2	General service tungsten lamps (60 to 1,000 watts)	2,800°K.—3,000°K.
3	Photoflood lamps	3,400°K.—3,500°K.
4	Photoflash lamps	approximately 4,000°K.
5	White flame arc	approximately 5,000°K.
6	Class A.1 Projector lamps (100-1,000 watts), and "Pointolite"	3,000°K.—3,000°K.
7	Over-run tungsten lamp (1,000 to 5,000 watts)	3,150°K.—3,300°K.

Code	Filter required for		
	D.1	D.2	D.4
1	D1/1	D2/1	D4/1
2	D1/2	D2/2	D4/2
3	D1/3	D2/3	D4/3
4	D1/4	D2/4	D4/4
5	D1/5	D2/5	D4/5
6	D1/6	D2/6	D4/6
7	D1/7	D2/7	D4/7

LOADING. Cut Film

Loading and unloading must be carried out in complete darkness. Dufaycolor film has to be exposed *through the base*, which must be kept free from finger marks, hence handle by the edges only. Cut film is packed six sheets in a box, all facing the same direction. Instructions for loading are contained in each box.

Roll Film, 35 mm. Miniature Camera Film

Dufaycolor roll film and Dufaycolor 35 mm. film for miniature cameras are handled in the normal way. When loading Dufaycolor 35 mm. refills into miniature camera cassettes, care must be taken to see that the *back* of the film faces the lens, otherwise a black and white picture will result.

EXPOSURE

Accurate exposure is essential, the nominal speed rating of Dufaycolor film is 20° B.S. Log. or 8 B.S. and A.S.A. Arith. This corresponds to approximately 21° Scheiner or Weston 6. However, some variation in speed occurs and each batch of film is coded to indicate the exposure increase or decrease needed:

Z—1 stop larger than standard exposure.
Y—Standard exposure as indicated by meter.
X—1 stop smaller than standard exposure.

The meter is set to the standard speed setting as recommended above and the exposure indicated by the meter is altered according to the speed code as printed on the filter packet. Example: If code is Z and meter indicates f8 at 1/25th second, then exposure should be f5.6 at 1/25th second.

PROCESSING

The sale price of Dufaycolor films does not include the processing charge. For those who do not wish to do their own processing, a processing service is provided by St. Annes Dufaycolor Processing Station, 48 Church Road, St. Annes-on-Sea, Lancashire; F. Caird Inglis & Son, 15 Meuse Lane, Edinburgh 2; and Lyall B. Smith, 8 Terenure Road East, Rathgar, Dublin, Eire.

PROCESSING CHART

According to local conditions, follow the procedure in either column A, B or C. See below for formulæ and special notes.

	COLUMN A	COLUMN B	COLUMN C
STAGE	Temperatures: 63° F. to 67° F. 17° C. to 19° C.	Temperatures: 68° F. to 74° F. 20° C. to 23° C.	Temperatures: 75° F. to 80° F. 24° C. to 26° C.
1 (See Note 1)	First Developer, use either D.S.2 or D.S.3	First Developer, use either D.S.2 or D.S.3	First Developer D.S.6
2		Stop Bath D.S.14 ½ minute	Stop Bath D.S.14 ½ minute
3		Wash 2 minutes	Wash 2 minutes
4		Harden in D.S.19 2 minutes	Harden in D.S.19 2 minutes
5	Wash 2 minutes	Rinse ½ minute	Rinse ½ minute
6 (See Note 1)	Bleach in D.S.15 2 to 5 minutes	Bleach in D.S.15 2 to 5 minutes	Bleach in D.S.15 2 minutes
7 (See Note 2)	White artificial light (not daylight) may be turned on		
8	Wash 3 minutes	Wash 3 minutes	Wash 3 minutes
9 (See Note 3)	Clear in D.S.17 ½ minute	Clear in D.S.17 ½ minute	Clear in D.S.17 ½ minute
10	Wash 2 minutes	Rinse 1 minute	Rinse 1 minute
11	Harden in D.S.19 5 minutes	Harden in D.S.19 5 minutes. Same bath as Stage 4	Harden in D.S.19 5 minutes. Same bath as Stage 4
12	Wash 2 minutes	Wash 2 minutes	Wash 2 minutes
13 (See Note 4)	Fog the film to white-light (not daylight) for about 30 seconds at 1 foot from a 100-watt lamp. Too much exposure is preferable to too little, but daylight must not be used.		
14 (See Note 5)	Redevelop in either 1st Developer used or any M.Q. developer	Redevelop in either 1st Developer used, or any M.Q. developer	Redevelop in D.S.8 for 5 minutes
15	Wash 10 minutes	Wash 10 minutes	Wash 8 minutes
16 (See Note 6)	Dry	Dry	Dry

In the manipulation of the film care must be taken to avoid fogging; uniform fogging (e.g. by an unsafe darkroom lamp) is not apparent as veiling, but causes a general loss of density and flattening of the image. As Dufaycolor film is coated with a hypersensitive panchromatic emulsion, it should be handled preferably in complete darkness prior to immersion in the bleaching solution. Safelights recommended for hypersensitive panchromatic materials may be used, but the film should be shielded from direct light until bleaching.

NOTES.

1. The film should be continually agitated while in the solution.
2. When the film has been in the bleach for half a minute or more, the white light may be turned on and the rest of the processing done in white light, not daylight. The film should be inspected to see if bleaching is complete. If any dark areas are present the film should again be agitated in the bleach bath. If the bleach bath turns muddy a new bath should be prepared and the film transferred to it.
3. If after agitating for one minute the film exhibits permanganate stains, a new bath should be prepared. This will only be necessary if a number of films has been through the bath.
4. The film should be thoroughly fogged by exposing it to a source of artificial light (not daylight), such as a 100-watt lamp for ½ to 1 minute at a distance of 12 in. (30 cm.). In hot climatic conditions where there is a danger of overheating the emulsion when close to the fogging lamp, the film should be placed in a dish with about an inch of cold water above it, the fogging lamp being held above.
5. If the first developer has been used as a second developer (Stage 14) it must never be used again as a first developer (Stage 1). Time about 5 minutes. Formula D.S.8 should be used in the tropics or where solution temperature variation is likely.
6. Surplus water should be removed by wiping the back of the film with damp cotton wool or chamois leather.
7. Dufaycolor cannot be satisfactorily desensitized.

FORMULARY

Formula D.S.2	British	Metric	U.S.A.
Metol	¼ oz. 5 grains	6.5 grms.	95 grains
Sodium Sulphite (cryst.)	4 ozs.	100 grms.	—
Sodium Sulphite (anhyd.)	—	—	1½ ozs. 75 grains
Hydroquinone ...	35 grains	2.0 grms.	30 grains
Sodium Carbonate (cryst.)	4 ozs.	100 grms.	—
Sodium Carbonate (anhyd.)	—	—	1¼ ozs.
Potassium Bromide ...	49 grains	2.75 grms.	40 grains
Potassium Thiocyanate (Sulphocyanide pure)	¼ oz. 49 grains	9.0 grms.	¼ oz. 22 grains
Water to	40 ozs.	1000 cc.	32 ozs.
Temperatures	65° F. 18° C.	70° F. 21° C.	75° F. 24° C.
Time in minutes ...	3¾	3¼	2¾

Formula D.S.3	British	Metric	U.S.A.
Stock Solution A			
Metol	53 grains	3.0 grms.	44 grains
Sodium Sulphite (cryst.)	4 ozs.	100 grms.	—
Sodium Sulphite (anhyd.)	—	—	1½ ozs. 75 grains
Hydroquinone ...	105 grains	6.0 grms.	88 grains
Potassium Bromide ...	49 grains	2.75 grms.	40 grains
Water to	32 ozs.	800 c.c.	26 ozs.
Stock Solution B			
Ammonia			
One of the following strengths:			
Sp.G. 0.880	212 minims	11 cc.	2⅝ fl. drams
Sp.G. 0.920	327 minims	17 cc.	4.3 fl. drams
Sp.G. 0.960	653 minims	34 cc.	—
Water to	8 ozs.	200 cc.	6 ozs.

N.B.—It is important that the specific gravity of the Ammonia is correct

For Use. Stock Solution A—4 parts. Stock Solution B—1 part.

Temperatures	65° F. 18° C.	70° F. 21° C.	75° F. 24° C.
Times in minutes ...	3	2½	2

Formula D.S.6	British	Metric	U.S.A.
Metol	¼ oz. 5 grains	6.5 grms.	95 grains
Sodium Sulphite (cryst.)	4 ozs.	100 grms.	—
Sodium Sulphite (anhyd.)	—	—	1½ ozs. 75 grains
Hydroquinone ...	35 grains	2.0 grms.	30 grains
Sodium Carbonate (cryst.)	4 ozs.	100 grms.	—
Sodium Carbonate (anhyd.)	—	—	1¼ ozs.
Potassium Bromide ...	49 grains	2.75 grms.	40 grains
Potassium Thiocyanate (Sulphocyanide pure)	¼ oz. 49 grains	9.0 grms.	¼ oz. 22 grains
Sodium Sulphate (cryst.)	4 ozs.	100 grms.	3¼ ozs.
Water to	40 ozs.	1000 cc.	32 ozs.

Temperatures	75° F. 24° C.	80° F. 26° C.	85° F. 30° C.
Times in minutes ...	3	2½	2¼

Formula D.S.8	British	Metric	U.S.A.
Amidol	¼ oz. 66 grains	10 grms.	¼ oz. 27 grains
Sodium Sulphite (cryst.)	3 ozs. 89 grains	80 grms.	—
Sodium Sulphite (anhyd.)	—	—	1¼ oz. 38 grains
Potassium Metabisulphite ...	88 grains	5 grms.	73 grains
Water to	40 ozs.	1000 cc.	32 ozs.

Formula D.S.14	British	Metric	U.S.A.
Acetic Acid (Glacial)	200 minims	10 cc.	2½ fl. drams
Water to	40 ozs.	1000 cc.	32 ozs.

Formula D.S.15	British	Metric	U.S.A.
Stock Solution A			
Potassium Permanganate ...	35 grains	2 grms.	30 grains
Ammonium Persulphate ...	9 grains	0.5 grms.	8 grains
Water to	20 ozs.	500 cc.	16 ozs.
Stock Solution B			
Sulphuric Acid (Conc.)	200 minims	10 cc.	2½ fl. drams
Water to	20 ozs.	500 cc.	16 ozs.
For Use. Stock Solution A—1 part. Stock Solution B—1 part.			
The mixture deteriorates when mixed. A fresh quantity should be used for each batch of films.			

Formula D.S.17	British	Metric	U.S.A.
Potassium Metabisulphite ...	1 oz.	25 grms.	¾ oz. 38 grains
Water to	40 oz.	1000 cc.	32 ozs.

Formula D.S.19	British	Metric	U.S.A.
Chrome Alum... ...	1 oz.	25 grms.	¾ oz. 38 grains
Water to	40 ozs.	1000 cc.	32 ozs.

Formula D.S.25	British	Metric	U.S.A.
Stock Solution A			
Sodium Thiosulphate (hypo) cryst. ...	1 oz.	25 grms.	¾ ozs. 38 grains
Sodium Carbonate (cryst.)	¾ oz. 23 grains	20 grms.	—
Sodium Carbonate (anhyd.)	—	—	¼ oz.
Water to	20 ozs.	500 cc.	16 ozs.
Stock Solution B (KEEP IN DARK)			
Potassium Ferricyanide ...	44 grains	2.5 grms.	37 grains
Water	20 ozs.	500 cc.	16 ozs.
For Use. Stock Solution A—1 part. Stock Solution B—1 part.			

Formula D.S.29	British	Metric	U.S.A.
Mercuric Chloride ...	¾ oz. 93 grains	24 grms.	¾ oz. 20 grains
Potassium Bromide ...	¾ oz. 93 grains	24 grms.	¾ oz. 20 grains
Water to	40 ozs.	1000 cc.	32 ozs.

AFTER-TREATMENT

Over-exposure produces thin transparencies with pale desaturated colours. Slight over exposure can be improved if intensified by the following method. If the film has previously been dried, it should be soaked in water for about 20 minutes, then bleached until white right through the emulsion in DS29. This takes about 3 to 5 minutes. The film should then be washed for 10 minutes in running water, and then blackened in a 5 per cent. solution of Sodium Sulphite. Finally it should be well washed for 20 minutes and dried.

Under-exposure produces dense transparencies with dark heavy colours. Slight under-exposure can be improved by the following method:

If the film has previously been dried, it should be soaked in water for about 20 minutes, and then reduced in a modified Farmer's reducer DS25. Immediately the general density appears correct by visual examination the film should be washed for 15 minutes, and intensified in DS29 by the method previously given. This will restore the maximum black and the picture.

SEPARATION NEGATIVES

Three-colour separation negatives can be made from Dufaycolor transparencies for printing by some of the print processes described on pages 389—397.

The negatives should be made on panchromatic plates recommended by the manufacturers as suitable for colour separation work. Ordinary tricolour filters are not suitable for making the separations, narrow-cut filters such as Chromex 523 (red), Chromex 524 (green), Chromex 525 (blue), should be used. An ultra-violet absorber is also recommended between the light source and the transparency, Chromex 2324/D.10 is suitable. Detailed instructions may be obtained from Dufay Ltd.

Ektachrome

(Kodak Limited, Kingsway, London, W.C.2)

Ektachrome film is a multilayer, subtractive type, colour film, designed for reversal processing by the user. It is available in two forms: Ektachrome (Daylight Type) and Ektachrome (Type B). The former is designed for exposure by daylight and its colour balance is adjusted to give the best rendering of the subject in bright sunlight on a clear day, that is under conditions of noon sunlight plus skylight. Ektachrome (Type B) Film gives results of correct colour balance when exposed by high efficiency studio lighting of a colour temperature 3,100°—3,200° K. No filters are required when either film is exposed under the conditions prescribed, but should the colour temperature of the lighting be higher or lower than the above figures, a suitable filter from the range given below should be used. B.T.H. Photopearl and G.E.C. Pearl Photographic lamps when used at their rated voltage have a light output within the colour temperature range quoted above for the Type B film.

EXPOSURE

Ektachrome, like any other form of colour film, needs a more precise estimation of exposure than monochrome film. The daylight-type film has a speed rating to daylight of 20° B.S. Log. or 8 B.S. Arith. and A.S.A. This corresponds to approximately 21° Scheiner or Weston 6. Ektachrome (Type B) Film has a speed rating to tungsten light 21° B.S. Log. or 10 B.S. Arith. and A.S.A. This corresponds to approximately 22° Scheiner or Weston 8. When used in daylight with the appropriate filter the speed rating is 19° B.S. Log. or 6 B.S., Arith. and A.S.A., which is approximately 20° Scheiner or 5 Weston.

The lighting ratio—i.e. the intensity range in the illumination falling on different parts of the subject—should not exceed 4 to 1, and a satisfactory normal range is 3 to 1. If the transparencies are required for print-making a range of 2 to 1 is easier to handle at later stages of the process. In addition, transparencies which are required for colour prints are best if slightly under-exposed rather than over-exposed. If the transparency is on the dense side, but is satisfactory when viewed with a fairly strong light, then in all probability it will be suitable.

COMPENSATING AND LIGHT BALANCING FILTERS

Filter	Use	Increase in Exposure
	FOR EKTACHROME (DAYLIGHT TYPE)	
Wratten 81B	Compensating filter for use with electronic flash tubes.	1/3 stop
Kodak CC 10M + CC 05B	Compensating filter for use with daylight fluorescent lamps.	2/3 stop
	FOR EKTACHROME (TYPE B)	
Wratten 85B	Compensating filter for use of Ektachrome Type B in daylight.	Use the appropriate daylight exposure index.
Wratten 81A	Compensating filter for use with Photoflood lamps.	1/3 stop
81C	Compensating filter for use with flashbulbs.	2/3 stop
Wratten 85B + CC 05M	Compensating filters for use with electronic flash tubes.	One stop
Kodak CC 20R + CC 05R	Compensating filters for use with white fluorescent lamps.	One stop
Wratten 82 82A 82B 82C	A series of pale blue filters which increase the effective colour temperature of the lighting.	 1/3 stop 1/3 stop 2/3 stop 2/3 stop
Wratten 81 81A 81B 81C 81EF	A series of pale amber filters which reduce the effective colour temperature of the lighting.	 1/3 stop 1/3 stop 1/3 stop 1/3 stop 2/3 stop

Note.—The use of Ektachrome Type B is not recommended by Kodak Limited with daylight type fluorescent lamps.

PROCESSING

Since Ektachrome film is intended for user processing, the sale price does not include this service. The processing service formerly offered by Messrs. Kodak has now been discontinued.

Processing Ektachrome film presents no great difficulty apart from the need to maintain the first developer at a specified temperature within half a degree either way.

Tank development is to be preferred to dishes, although small quantities can be developed in dishes provided the greatest care is taken. The use of standard spiral groove roll film developing tanks for the smaller sizes of cut film should not be overlooked. For $3\frac{1}{2} \times 2\frac{1}{2}$ in. film this method has consistently given good results. However, for the larger sizes commonly used in professional practice, a set of six, or seven, standard 2 litre tanks is the most satisfactory procedure.

To maintain the temperature constant all the tanks can be placed in a large metal tank filled with water held at the specified temperature, if the whole darkroom cannot be maintained at this temperature.

Other equipment which will be needed comprises a number of stainless steel sheet film hangers, a thermometer and a darkroom timer. A No. 1 Photoflood is required for the reversal exposure and this should be shielded from water drops by a glass sheet.

PROCESSING PROCEDURE

Apart from the first developer the temperature tolerance is quite wide and is given for each step. The film should be agitated once every minute whilst it is in the solutions and the method recommended is lifting the film out of the solution completely and draining from one corner for five seconds. The film should be drained alternately from each of the bottom corners and it is important to adhere rigidly to this procedure.

The steps of the process are as follows:

1. *First development* at 75° F. ± ½° F. for 10 minutes. This must be done in total darkness and should be carefully timed.
2. *Rinse* for 1 minute in running water at 73° to 77° F.
3. *Harden* in the hardening bath for 3 to 10 minutes at 73° to 77° F. After the first 3 minutes the room lights may be turned on and the rest of the processing can be carried out in white light. The film should *not* be rinsed between this step and step 4.
4. *Expose* each side of the film for 5 seconds to a No. 1 Photoflood.
5. *Wash* for 3 minutes in running water at 73° to 77° F.
6. *Colour develop* for 15 minutes at 73° to 77° F.
7. *Wash* for 5 minutes in running water at 73° to 77° F.
8. *Clear* in the clearing and fixing bath for 5 minutes at 73° to 77° F.
9. *Rinse* for 1 minute in running water at 73° to 77° F.
10. *Bleach* in the bleach bath for 8 minutes at 73° to 77° F.
11. *Rinse* for 1 minute in running water at 73° to 77° F.
12. *Fix* in clearing and fixing bath for 3 minutes at 73° to 77° F. This is the same solution as is used in step 8.
13. *Wash* for 8 minutes in running water at 73° to 77° F.
14. *Wipe down* the film with a viscose sponge or immerse in a solution of wetting agent.
15. *Dry*. When the film is wet it appears opalescent and too yellow in colour balance, but as it dries it gradually assumes a more normal appearance.

FORMULÆ

The formulae of the above processing solutions have not been published by Kodak Limited, but all the necessary chemicals are available in the form of a kit which will make 70 ounces (2 litres).

However, independent workers have evolved satisfactory substitute formulæ from time to time, which are more convenient if smaller quantities of the baths are desired, since once mixed and used the solutions will not keep for more than a week. Unused solutions will keep in tightly stoppered bottles for two weeks. Satisfactory substitute formulæ will be found in "Epitome of Progress" in the *British Journal Photographic Almanac* for 1953.

SEPARATION NEGATIVES

Excellent colour prints can be made from Ektachrome transparencies by some of the recognised print processes described on pages 389—397. The recommended plate for this purpose is the Kodak P.1200 and the following filters should be employed: red, Wratten 29(F); green, Wratten 61(N); blue, Wratten 49(C4) plus 2B.

For the best results, the transparency should be masked with both a red filter mask and a green filter mask made by exposing P.1200 plates through the transparency to a light source filtered with a Wratten 29(F) filter and a Wratten 61(N) respectively. In both cases the masks should have a gamma of about 0.3. Very full details of the correct method of making these masks and separation negatives can be found in the Kodak Data Sheet CL-1.

Ferraniacolor Reversal

(Neville Brown & Co. Ltd., 77 Newman Street, London, W.1.)

Ferraniacolor Reversal film is a multilayer subtractive material which has the colour couplers incorporated in the emulsion layers. The film is available in daylight type only and in a range of sizes and packings; 20 exposure cassettes of 35 mm. film, 6 × 9 cm. roll film and standard sheet film sizes. Ferraniacolor is used in the camera in the same way as black and white film.

EXPOSURE

The speed of Ferraniacolor Reversal film is 24° B.S. Log. or 20 B.S. or A.S.A. Arith. which corresponds to 25° Scheiner or 16 Weston. As with all colour material the exposure latitude is rather limited and hence exposure must be accurate for good results. The use of a good photo-electric exposure meter is recommended by the manufacturer. Strong contrasts in the lighting should be avoided and exposure should not be attempted early or late in the day or on dull days. It is also suggested that pictures of near subjects are to be preferred and that only lenses of good colour correction and good definition be used. A lens hood should always be used. When industrial haze is present (within 20 miles of any large inland British town) one half to one stop more than normal exposure should be given.

PROCESSING

Processing kits manufactured by Johnsons of Hendon are available in both amateur and professional size packings. The processing of Ferraniacolor Reversal film is a simple operation which can be conducted with the minimum of extra equipment over and above that generally used for black and white film processing. For miniature and roll films the standard spiral groove tank is perfectly satisfactory and cut film may be processed either in deep tanks or the tanks specially adapted for processing this format in daylight. A Photoflood lamp is required for the reversal exposure.

PROCESSING PROCEDURE

Apart from the first developer and the colour developer all the solutions may be used at temperatures between 63° and 67°F. With the recommended processing times the film should be agitated for 10 seconds every minute in all the solutions. The steps of the process are as follows:

1. *First development* at 65°F. ± ½°F. for 20 minutes. This must be done in total darkness and carefully timed.
2. *Wash* for 20 minutes in running water. If standard roll film tanks are used these should be emptied completely four or five times during the total time.
3. *Expose* each side of the film for about 1½ minutes to a No. 1 Photoflood at 2½ feet or a 100 watt pearl lamp at 1 foot.
4. *Colour develop* for 10 minutes at 65°F. ± ½°F.
5. *Wash* for 20 minutes as recommended at stage 2.
6. *Harden* for 5-8 minutes. The shorter time will apply to fresh solutions, the longer to solutions which have been used to process earlier films.
7. *Wash* for 5 minutes.
7. *Bleach* for 10 minutes.
9. *Wash* for 5 minutes.
10. *Fix* for 5-8 minutes.
11. *Wash* for 20 minutes with final rinse in wetting agent.

Care must be taken not to exceed the temperature tolerances given. Higher temperatures, particularly in soft water districts may cause small blisters and emulsion marks. In such conditions it may prove helpful to immerse the film in a 2% solution of magnesium sulphate immediately after colour development and before the wash at stage 5.

FORMULÆ

The formulæ of the processing solutions referred to above have not been published but satisfactory substitute formulæ and timings were given in the *British Journal of Photography* for 2nd October, 1953, and in the " Epitome of Progress " section of this *Almanac.*

SEPARATION NEGATIVES

Separation negatives may be made from Ferraniacolor Reversal transparencies using the same technique and filters recommended for other processes of the integral tripack type.

Gevacolor Reversal

(Gevaert Ltd., Acton Lane, Harlesden, London, N.W.10)

Gevacolor is a multilayer subtractive colour transparency material of the reversal and colour development type. The film is made in two types giving positive transparencies, R5 and R3—for daylight and for artificial light respectively. Both types are coated on safety base only and are made in miniature film, 20 exposures 24 × 36 mm.

on perforated 35-mm. film. The type for daylight is also made in roll-film sizes 120, 620 and 127. Gevacolor is loaded in the same way as ordinary film, and no filter is required.

EXPOSURE

The speed of both types of Gevacolor is 22° B.S. Log. or 12 B.S. and A.S.A. Arith which corresponds to 23° Scheiner or about 10 Weston.

Exposure should be determined accurately by means of a photo-electric exposure meter, since the latitude is much less than in black and white photography. It is advisable, in this connection, to make a test exposure using the readings on one's own meter. According to the results obtained from this initial exposure, the indication given by the meter can be modified if necessary on all future exposures. In daylight an even lighting is recommended. Stand preferably with your back to the sun, the subject being lighted from the front. Good results can be obtained on sunny days, when there are large white clouds in the sky to reflect and diffuse the sunlight and thus reduce contrasts. Sunny weather with a very slight haze also gives excellent transparencies.

As a general rule, *avoid :*

(1) Photographing against the light.

(2) Subjects partly in sunlight and partly in the shade, and in general all subjects with very heavy shadows side by side with very bright highlights.

(3) Strong side lighting.

(4) Sunlight shining directly on to the head of the sitter, which produces deep shadows under the eyes and chin, etc.

The artificial light type of film is specially made for use with over-run lamps of the 100-hour type, at a colour temperature of 3,200° K. Ordinary bulbs give too yellow a picture and must not be used.

It is recommended to use *front* lighting and to keep it as even as possible. Contrast is obtained by differences in colour and not by light and shade. For preference, have several lamps around the camera at carefully chosen levels, taking care to avoid contrasty lighting and cast shadows.

PROCESSING

The cost of processing Gevacolor Reversal films R3 and R5 is *not* included in the purchase price and the films should be sent to the official Gavaert processing station for development. For reversal films this is Allcolor Services, 148 Southampton Row, London, W.C.2. The cost of processing a 20 exposure cassette of 35 mm. film is 7s. 6d. and the charge for roll films is 7s. 0d.

For those workers who prefer to process their own films satisfactory substitute formulæ have been published in the *British Journal of Photography* for 2nd and 23rd October, 1953. These are abstracted in the " Epitome of Progress " section of this *Almanac*.

SEPARATION NEGATIVES

Separation negatives may be made from Gevacolor transparencies using the same technique and filters recommended for other processes of the integral tripack type.

Ilford Colour Film

(Ilford Ltd., Ilford, London)

Ilford Colour Film " D " is correctly balanced for use in daylight without a filter, but when photographing distant landscapes, snow scenes, scenes at high altitudes, some improvement in colour may be effected if an Ilford Q filter is used. No increase in exposure is necessary.

Exposures in Photoflood light with the daylight film can only be made with a special compensating filter, Ilford Filter No. 351. The film will be effectively slower in artificial light than in daylight. A speed value of Weston 2 is suggested, this is equivalent to 15° B.S.I. Log. Ilford Colour Film is available only in 35 mm. 20 exposure cassettes.

EXPOSURE

The speed of Ilford Colour Film " D " in sunlight is Weston 8, and the equivalent logarithmic speed index on the B.S. scale is 21°. This corresponds to B.S. and A.S.A. 10 Arith. Exposure is more critical than with black and white film and small variations in lens aperture and shutter speed, which are relatively unimportant for black and white photography, may produce appreciable changes in colour transparencies. It is, therefore, important to bear this in mind when calculating exposure times. An exposure guide is enclosed in every carton of Ilford Colour Film.

When Ilford Colour Film is used in artificial light with the No. 351 filter the lighting contrast, as is usual with reversal monopack film, should be kept low.

To ensure that the lighting is of a suitable contrast, the manufacturers recommend that a photoelectric meter reading be made on white card held in the main shadow area. This reading should not be less than ¼ that obtained on the same white card at the point of brightest lighting. If a lower value is obtained extra lights or reflectors should be used to increase the shadow illumination. To improve the colour rendering of the background, it is desirable that it should be illuminated to give a white card reading of not less than about half the highlight reading.

PROCESSING

Ilford Colour Film is an integral tripack which does not carry the colour formers itself and, therefore, cannot be processed by the user. The exposed film must be returned to the Ilford Processing

Station at Brentwood in the cassette and aluminium container provided. A bag with addressed label is also supplied to facilitate despatch. The colour transparencies are returned in cardboard mounts unless Ilford Limited are instructed otherwise.

Although the user is requested to send exposed films to the Ilford factory at Brentwood, it should be noted that all technical enquiries should be addressed to Ilford Limited, Ilford, London.

PRINT SERVICE

Colour prints of the standard size of $5\frac{1}{2} \times 3\frac{7}{8}$-ins. on white plastic base can be made from Ilford Colour Film transparencies. Transparencies from which prints are to be made should be returned to Ilford Ltd. through any authorised photographic dealer.

SEPARATION NEGATIVES

Transparencies which are soft and slightly under-exposed, to retain all the highlight detail, give the best colour prints. The recommended material for the separation negatives is H.P.3 35 mm. film in contact, emulsion to emulsion, with the transparency. A suitable source of white light is a 100-watt gasfilled lamp behind an opal screen, and the light should be filtered with Ilford Narrow Cut Tricolour Filters, Nos. 306, 408 and 205.

A test should be made through one of the filters to select the exposure needed to give detail in the shadows. When this has been done, a set of three negatives can then be exposed, the approximate factors for the filters being: blue 27, green 6 and red 5.

The negatives should be developed all together in ID 11 at 68° F., with uniform agitation for 7 minutes. Under these conditions the contrast of all the three negatives will be the same.

Johnson Colour Screen Process

(Johnsons of Hendon Ltd., Hendon Way, London, N.W.4)

The Johnson Colour Screen Process is an additive mosaic-filter system which uses two separate plates, one to carry the reseau and the other the emulsion. In this way one screen plate can be used repeatedly and the sensitive materials used are normal panchromatic plates. It will be seen that this was the system used in the Finlay process which ceased to be marketed some years ago.

The separation of the carrier for the reseau and the carrier for the emulsion has the advantages of low cost of sensitive material—identical with black and white—and increased exposure latitude, since the plate is not processed to a reversal positive. In addition, as many duplicates as may be required can be made with no loss of quality, and the contrast and the saturation of the finished transparency can be varied within quite wide limits. Also since the filters used in the taking screen need not be those used for the viewing screen more suitable characteristics can be chosen for each. A finished transparency can be produced within an hour. The screens are available in all standard sizes from $3\frac{1}{4} \times 3\frac{1}{4}$-ins. to 10×8-ins.

MANIPULATION

The taking screen is a sheet of thin glass carrying a regular red, green and blue filter mosaic of 175 squares to the inch. In the dark-room this screen is placed in contact with the emulsion side of a suitable panchromatic plate and the two then loaded into the darkslide so that the screen plate faces the lens. The contact between the two plates must be good and bookform slides are recommended. If other types are to be used, panchromatic plates coated on thin glass must be used. These are available from Messrs. Johnsons.

The lens should be a good quality anastigmat of fairly long focal length, and at large apertures the ground glass should be reversed to correct for the thickness of the taking screen.

SENSITIVE MATERIALS AND BALANCING FILTERS

Light Source	Sensitive Material	Filter
Daylight electronic flash & blue coated flashbulbs	Kodak P.1200 ...	Johnson J.D.1
	Ilford S.G. Pan ...	Johnson J.D.2
500 watt Photopearl ...	Ilford S.R. Pan ...	Johnson J.W.1
" " " ...	Gevaert Microgran Panchro	Johnson J.W.2
Photoflood ...	Kodak P.1200 ...	Johnson J.P.2
" ...	Gevaert Microgran Panchro	Johnson J.P.2
Pointolite Lamps... ...	Gevaert Microgran Panchro	Johnson J.P.T.1
" " ...	Ilford S.R. Pan ...	Johnson J.P.T.2

EXPOSURE

The working speed of this process depends on the speed of the panchromatic plate used. The colour screen and filter reduce the normal speed of the plate by 4 to 5 times in daylight and 10 to 15 times in artificial light. For each type of light source given in the table above, the first of each pair of plate and filter combinations gives the highest speed. The second pair gives a speed of about half the first but rather higher contrast.

When blue coated flashbulbs are used a guide number of 64 for Philips Photoflux PF 25/97, 96 for PF 60/97 and 128 for PF 100/97 should give well exposed transparencies using the recommended filter and plate combinations.

For electronic flash using a 500 joule flashtube a guide number of 36 for Kodak P.1200 plates and the J.D.1 filter has been found satisfactory. Using Ilford Soft Gradation Pan plates and the J.D.2 filter a guide number of 25 is recommended.

PROCESSING

After exposure the plate is developed in the normal manner, but to lower than normal contrast. The manufacturers supply a special developer, Johnsons Colour Screen Negative Developer, which gives negatives of satisfactory gradation with reasonably brief developing times. Using this solution at 65°F. the following developing times should be used for normal contrast:—

Kodak P.1200	3 minutes
Gevaert Microgran Panchro	3-4 minutes
Ilford Soft Gradation Pan	3-4 minutes
Ilford Special Rapid Pan	2½-3 minutes

These times can be increased in the case of subjects of low inherent contrast.

PRINTING

The negative, after processing, is printed by contact on to a Johnson Positive Plate. The contact between the negative and positive plate must be good and the light source must be small, undiffused and at some distance from the printing frame. A 15-watt lamp masked with a sheet of card in which a ¼-in. hole has been cut at a distance of 5-ft. is recommended. Under these conditions exposures will be in the region of 10 seconds. Alternatively, an enlarger may be used as a light source with the lens stopped down to f/16 or less.

PROCESSING THE POSITIVE

Some control of contrast is again possible at this stage. A normal negative will give a suitable positive when the latter is developed in Johnson Universal Developer diluted 1-4 for 2 minutes at 65°F.

For increased positive contrast Johnsons Line Contrast Developer should be used for up to three minutes at 65°F., while the contrast can be reduced by developing the positive plate in Johnsons Colour Screen Negative Developer for 2-3 minutes.

REGISTRATION

The transparency is completed by binding up the positive, when dry, with a viewing screen, which is a similar filter mosaic to the taking screen. The two are held together face to face over a diffused light source with the screen uppermost. Holding the two plates together by their corners the screen should be rotated over the positive, about its centre. On rotation a pattern of squares will appear, grow larger and finally disappear as the screen is rotated. When the pattern has disappeared, the plates should be clamped together with four Bulldog clips. If the colours of the picture do not appear correct the plates should be viewed from various angles until they do. The screen should then be gently moved in this direction until the colours are correct when viewed directly. Two of the clips are then removed and these two sides bound with binding tape. The clips should be replaced on these two sides and the other two then bound.

AFTER-TREATMENT

Both the negative and the positive can be intensified or reduced in the normal way, but any treatment used for the positive must produce a neutral black image. Chromium intensifier with Amidol as a second developer is recommended.

Kodachrome

(Kodak Limited, Kingsway, London, W.C.2)

Kodachrome is supplied for 16-mm. and 8-mm. cine cameras, in cassettes of 20 exposures for 35-mm. miniature cameras, and in 8-exposure spools for Bantam cameras. Two types are available: Daylight Type and Type A.

Daylight Type Kodachrome is designed for daylight use only, without a colour-correcting filter. Since, however, any excess of ultra-violet rays is liable to upset the colour balance, by exaggerating the blue-violet record, it is frequently advantageous to use a Wratten Filter No. 1a for outdoor exposures: this applies particularly to photography at high altitudes, at the coast, or in the vicinity of water. No increase of exposure is required.

EXPOSURE

The exposure index numbers for Daylight Type Kodachrome are 21° B.S. Log. or 10 B.S. Arith. and A.S.A. (Weston 8). Exposures need to be about 3 times greater than with Panatomic-X film (26°-32), or at an aperture about 2 stops larger than with Kodak Super-X Panchromatic 16-mm. film (27°-40). In general an even, flat lighting is to be recommended: strong lighting effects can, however, be used with success, so long as heavy contrasts of light and shade are avoided. A reliable guide to exposures is supplied by the makers with every carton of film.

Kodachrome Type A is specially made for use with artificial light without a filter, and gives the best rendering with Photoflood lamps: under these circumstances the exposure index numbers are 23° B.S. Log. or 16 B.S. Arith. and A.S.A. (Weston 12). It can also be used for daylight exposures by the addition of the Type A Kodachrome Filter for Daylight (Wratten No. 85), when its speed becomes identical with that of Daylight Type Kodachrome. A detailed exposure table for artificial light is supplied with the film.

PROCESSING

Kodachrome film cannot be processed by the user: processing is undertaken by Kodak Limited, and the cost of processing is included in the price of the film. Film should be returned for processing as soon as possible after exposure. It should not at any time be exposed to damp or heat.

SEPARATION NEGATIVES

It is recommended that separation negatives from 35-mm. Kodachrome transparencies be made with a suitable miniature enlarger. The transparency, which should be on the under-exposed side and a little too dense for normal projection, should be mounted on a Kodak Marginal Mask Plate. This plate includes a step wedge, the steps of which correspond to the perforations of the 35-mm. film, which makes the control of the processing of the separations and any masks much more precise.

A red filter mask, which is recommended for reducing the overall contrast of the transparency and brightening the blues and greens, should be made on a P.1200 plate the same size as the mask plate. A Wratten No. 29(F) or 33 filter should be used to expose the mask, which should be developed to a gamma of about 0.3.

For the Kodak Precision Enlarger, a special light-tight negative carrier holds both the Marginal Mask Plate and the contrast mask.

The separation negatives should be made on P.1200 plates using the Wratten Narrow Cut Tricolour set of filters over the enlarger lens. These filters are No. 29(F) red, No. 61(N) green, and No. 49(C4) blue.

Very full details of the correct method of making these separation negatives and masks can be found in the Kodak Data Sheet CL-1.

COLOUR PRINT PROCESSES

Duxochrome

(Johannes Herzog & Co., Holzstrasse 1-3, Bremen, Germany)

Duxochrome is a subtractive print process in which three pigmented gelatin images are assembled, in register, on paper. The coloured Duxochrome films contain light sensitive silver halide, so that an image can be produced in them by normal methods of exposure through a negative, and subsequent development. A relief image is produced by the use of a tanning developer and hot water etching baths.

In order to obtain a good colour print it is essential that the negatives be correctly exposed and not of too great contrast. These negatives may be produced by any of the normal colour separation methods—separate exposures, repeating back cameras, one shot cameras, or from colour transparencies. Negatives from which enlargements are to be printed should be rather softer than those for contact printing.

Materials required

1. Duxochrome film, yellow, cyan and magenta.
2. Duxochrome developer A and B.
3. Distilled water.
4. Acid hypo fixing bath (without alum).
5. Hot water.
6. Hypo bath 1 to 10.
7. Acetic acid in a dropping bottle.
8. Duxochrome silver bleach.
9. Potassium Permanganate 1% solution.
10. Clearing bath.
11. Duxochrome " fixator ".

PRINTING

The speed of the Duxochrome films is about that of high-speed gaslight or bromide papers. The film should be handled in the dark-room by an orange-red light. In order to find out the correct exposure time, the trial strips which are enclosed in the packets should be used.

EXPOSURE

Must in all cases take place through the uncoated, glossy, celluloid side. Exposure has been correct when, after first washing out, the highlights still show all details; too short, when the highlights appear transparent without showing any details; too long, when the highlights are veiled with colour.

DEVELOPMENT

The exposed films are developed in the special Duxochrome developer which is diluted according to the contrast of the negatives being used and the final print contrast desired:

	Solution A+B	Dist. Water	Temp.	Time
Normal Negs.	each 60 c.c.	400 c.c.	65°–68° F.	4–5 mins.
Hard Negs.	each 40 c.c.	400 c.c.	68°–77° F.	3–4 mins.
Soft Negs.	each up to 160 c.c.	400 c.c.	60°–65° F.	5–10 mins.

Distilled water must be used in mixing up the developer. The above quantities will develop three films 7 in. × 5 in., together. No account should be taken of the appearance of the image. This commences to build up from the celluloid side (through which it was exposed), and only a faint image may be seen on the magenta and yellow films, while it will be almost invisible on the cyan. This, however, is quite in order, and the positive in its final form will not be seen until after the hot-water bath.

FIXING

Without rinsing in water, transfer the films to an ordinary acid-hypo fixing bath (free from alum). It is very important that the bath must not be used after it has become tinted brown. The rest of the work can be carried out in daylight.

WASHING OUT

When the films are completely fixed, usually after 5-10 minutes, they should be rinsed for 3 to 4 minutes in cold water. Then each of the films in turn is washed out in hot water at about 120° to 140° F. (50° to 60° C.). Films must not be washed out together, or the colours will become degraded. The yellow film will appear more brilliant if 5-10 drops of acetic acid are added to each pint (500 c.c.) of hot water used first for washing. Acetic acid has an etching effect and, therefore, should be added by means of a dropping-bottle. Washing out is effected by placing the film, emulsion side up, in a suitably sized dish, and pouring on the hot water from a small pot or jug. In pouring on, the water should be flushed over the whole surface of the film. The water is then poured back from the dish into the pot and this process repeated. As the surface emulsion washes away, the water will become coloured and should be replaced with fresh water. This process should be carried on until no discoloration of the water takes place.

SILVER BLEACHING

The films should now be placed in a bath of Duxochrome desilverer, which will fully remove the silver after 5 minutes; the film will now appear whitish. This bath may be used repeatedly. After rinsing, the films are placed in the clearing bath to fix—at least 5 minutes. The clearing bath should be made up from Potassium Metabisulphite 1 oz. (28 grm.), Hypo 3 oz. (85 grm.), Water 35 fl. oz. (1 litre). If after this time in the bath the cyan film flows a reddish tint, it must be replaced for a minute or two. Afterwards the films should be washed in running water.

COLOUR BALANCING

At this stage the three positives may be superimposed, while still wet (first yellow, then cyan, then magenta), on the bottom of a large white porcelain dish. This will give some idea of the appearance of the finished print. Each positive must appear as delicate as possible. If any one colour predominates, the film concerned may be immersed in very hot water, or any special place on the film may be washed with a piece of cotton wool which has been soaked in hot water. This will reduce it slightly, and the temperature of the water may be increased up to 176-194° F. (80°-90° C.). The film that is being reduced should be tried from time to time with the other two films in order that the correct balance of colour may be obtained.

FIXING THE COLOUR

The cyan film alone should now be immersed for 3-4 minutes in the Duxochrome Fixator solution. The diluted bath may be used repeatedly as long as it keeps bluish. (A greenish bath must no longer be used.) Then rinse in cold water. After this bath, the three films should be again checked for colour balance as the cyan film may lose some of its intensity.

TREATMENT FOR OVER-EXPOSED MAGENTA AND YELLOW FILMS

Bathe in the following solutions:

1 % solution of Potassium Permanganate	170 mins. or 10 c.c.
Water	7 fl. oz. or 200 c.c.

Wash until the water is clear, then immerse in the following:

Potassium Metabisulphite	2 oz. or 50 gm.
Hypo	2 oz. or 50 gm.
Water	35 fl. oz. or 1 litre.

The latter solution may be used repeatedly, but the permanganate may be used once only.

TRANSFERRING TO PAPER

The films are hung up to dry, and this may be hastened by means of gentle heat or the use of an electric fan, until they are bone dry.

Take the yellow positive and a sheet of transfer paper, which has been soaked in warm water of 120° F. for some minutes, and place them, face upwards, in a dish of water and allow to soak for 10-15 minutes. Then, beneath the surface, place the gelatin side of the colour film next to the prepared side of transfer paper, removing these together from the water, and being careful that no air-bubbles remain between the two sheets. Place on a sheet of glass which is covered with a rubber-cloth. roll with a squeegee to force out the surplus water and any air-bubbles. Place the transfer paper and colour film between a few sheets of damp blotting paper, and leave in a copying press under fair pressure about 10 minutes. If the worker does not possess such a press, two thick pieces of wood, hinged to open like a book, may be used with clamps round the sides to give the requisite pressure, which must be fairly heavy.

After removal from the press, the transfer paper, with celluloid must be dried, and this may be hastened by gentle heat in a print dryer. When completely dry, the celluloid will strip off cleanly, leaving the yellow image on the paper. (Failure of the celluloid to come away readily, indicates that drying is not complete.)

The cyan film and the transfer paper bearing the yellow image are now soaked until exact register is obtained, and brought out, face to face, with precautions against air-bubbles, and lightly squeegeed, the two images then being shifted to coincide exactly, using a magnifier if necessary. The print, now appearing green, is placed between blotting paper and subjected to pressure in the press for 10 minutes. The celluloid will strip off when the print is dry, as with the yellow.

Then proceed in similar manner to transfer the magenta image. Always soak until exact register is effected, since different lengths of time cause different degrees of expansion of the transfer paper.

SURFACE TREATMENT

When the last of the celluloids has been removed, the print will have a very glossy surface. To produce a semi-matt effect, soak for 2 minutes in warm water and dry in cool air.

RETOUCHING

Any retouching necessary is carried out with the special Duxochrome dyes supplied. The print should be soaked in warm water for 2 minutes and allowed to dry before retouching.

Dye Transfer

(Kodak Limited, Kingsway, London, W.C.2)

The Dye Transfer Process is an improved method of making colour prints on paper. The new process is both faster and simpler than the old Wash-Off Relief Process, which preceded it. Shortage of necessary chemicals, and difficulties in obtaining special materials, have delayed its general release in Great Britain. Training facilities are available for professional photographers.

For this reason only a brief outline of the process is given here, together with an account of the improvements in the process.

As in the Wash-Off Relief Process, three colour-separation negatives are required. These negatives can be made from colour transparencies or direct from the subject. Positive images are printed from these negatives on separate sheets of matrix film. These matrices are processed so that each bears a positive relief image in gelatin, an image which will absorb dye in proportion to its thickness and from which that dye can be transferred. When the three matrices are dyed cyan, magenta, and yellow respectively, and the dye images are suitably transferred in register to a single sheet of Dye Transfer paper, a colour print results.

The Dye Transfer Process has several advantages over former imbibition processes, chiefly in that the colour prints have improved quality, notably because of improved colour saturation. In addition the technique provides greater ease of control, because colour balance can be adjusted and contrasts can be increased or reduced. Finally the process takes less time.

These improvements are obtained by a combination of changes in the chemistry of the process with improvements in the operating technique.

A tanning developer is used, which produces the hardened gelatin image simultaneously with the production of the silver image. This eliminates the steps of bleaching, fixing and washing ; it shortens the processing of matrices.

The silver image is left in the gelatin relief matrices, so that when dry they may be bound together in register, and then trimmed together on two adjacent edges. Then register during dye transfer is obtained mechanically by setting these trimmed edges against locating buttons on a Dye Transfer Blanket.

As a result of this improved technique of handling the matrices, it is possible to use new dyes, which are absorbed and transferred much more rapidly.

Control of the process is applied primarily in the development of the matrices, but further control of colour balance is possible by altering the composition of the acid rinse used after dyeing. It is therefore not necessary to adjust the dye baths for individual subjects. A system of replenishments keeps the dye baths at constant strength for making successive duplicate prints.

After the matrices are dyed, the dye images are transferred in sequence to the pre-mordanted Dye Transfer paper by means of the Dye Transfer Blanket.

The Dye Transfer Blanket is hinged to a heavy smooth-surface board. On the underside of the blanket are accurately fixed four locating buttons, against which the trimmed edges of the matrix are positioned just before the dye image is to be transferred. The blanket with matrix in position is swung over the board and held at a low angle over the Dye Transfer paper, but it is not allowed to touch the paper. Contact is made by a single sweep with a suitable print roller.

The time required to produce a finished colour print from the dyed matrices is less than 30 minutes. Successive prints can be made in about 20 minutes each.

Synthacolor

(British Synthacol Ltd., Rowsley Works, Reddish, near Stockport, Cheshire.)

Synthacolor paper is a monopack material coated with three emulsion layers. The top layer is blue sensitive and contains a yellow coupler, the second layer is green sensitive and contains a magenta coupler and the lower layer is red sensitive and contains a cyan coupler; thus on development with a suitable solution the appropriate complementary coloured dyes are generated in each of the three layers. Synthacolor paper is intended for the making of colour prints from any of the commercially available colour negative materials.

PRINTING

Prints may be made on Synthacolor paper either by contact or enlargement. Standard equipment is used but should incorporate a voltage control in the lamp circuit and provide facility for the placing of filters in the light beam, preferably between the lamp and the negative in the case of an enlarger. The basic colour correcting filter, called the " R " filter should be placed between the enlarger lens and the paper.

Test strips are provided in each packet of paper and a test print on normal bromide paper is recommended as an aid to correct exposure before the colour paper test strip is made. Selection of a suitable correction filter on the basis of the unfiltered colour test strip needs some care and practice but when some skill has been attained this can be done without the use of a great deal of paper.

PRINTING

Printing and processing kits are available; the printing outfits consist of a supply of paper, a set of 36 correction filters—12 each of yellow, cyan and magenta in densities from 0.05 to 0.60, and a basic " R " filter for correction of the light source. The processing kit contains all the necessary chemicals to make one litre of the six solutions needed for processing the paper.

When the paper has been exposed through the colour negative either by contact or by enlargement it is processed through the following stages:

1. *Colour develop* in Synthacolor developer for 8 minutes at 68°F. with continuous agitation.
2. *Stop* in the first stop bath for 3 minutes at 60-65°F.
3. *Stop* in the second stop bath for 3 minutes at 60-65°F.
4. *Wash* in running water for 4 minutes at 60-65°F.
5. *Fix* in the first fixer for 5 minutes at 60-65°F.
6. *Wash* in running water for 5 minutes at 60-65°F.
7. *Bleach* for 2 minutes at 60-65°F.
8. *Wash* in running water for 5 minutes at 60-65°F.
9. *Fix* in the final fixing bath for 4 minutes at 60-65°F.
10. *Wash* in running water for 20 minutes at 60-65°F.

The total processing time is 59 minutes and the print may be examined by the light of a bright orange safelight after the first fixing bath i.e. 28 minutes. For the early stages of the processing the deep green Synthacolor No. 1 safelight must be used. The print may be examined by artificial light after the final fixing bath and may be cold glazed if desired, after immersion in a 2% solution of formaldehyde.

Trichrome Carbro

(The Autotype Company Ltd., Autotype Works, West Ealing, London, W.13)

The Trichrome Carbro Process is a subtractive colour print process whereby prints in full colour may be made by enlargement or contact from the usual set of separation negatives, or, of course, via separation negatives, from any original colour transparency.

From each of the three separation negatives a bromide enlargement is made and from these in turn Carbro prints: from the red filter negative a cyan print; from the green filter negative a magenta print; and from the blue filter negative a yellow print.

The Carbro prints are developed on transparent supports and the images are subsequently transferred in register on to white paper, so forming a natural colour print.

THE BROMIDE PRINTS

The bromide enlargements are made with narrow white margins on unsupercoated bromide paper, such as the special Carbro paper, by time and temperature methods and thoroughly fixed and washed. Any standard non-staining developer is suitable, and the fixer may be plain or acid hypo; it must, however, contain no hardening agent.

After fixing and washing, the bromides should be immersed in a 2% solution of acetic acid and then again washed.

Once the bromides have been made the remainder of the process can be carried out in diffused daylight.

MAKING THE COLOUR RELIEFS

Two sheets of celluloid should be hinged together, like the covers of a book, with adhesive tape. The cyan printer bromide enlargement should be soaked in buffer solution for several minutes and laid face upwards on one sheet. A piece of Autotype Trichrome cyan pigment paper should, after sensitising in one of the solutions given in the formulæ, be placed on the unoccupied leaf of celluloid in such a way that it registers with the bromide. The two should then be brought into contact by rolling down with a roller squeegee (hand or mangle type). The pigment paper—bromide sandwich should be taken from between the celluloids, placed between waxed papers and left for 10 minutes.

During this time the sheets of magenta and yellow pigment paper can be processed similarly with their respective bromide prints. After 10 minutes in contact each pigment paper is stripped from the bromide print and then squeegeed to a sheet of "Perspex", "Vinylite" or other suitable transparent plastic sheet. After 10 minutes each plastic-pigment paper sandwich should be taken in turn and placed in warm water at about 105° F., whereupon pigment will begin to ooze from round the edges of the paper which can then be pulled away gently and discarded, leaving a mass of pigmented gelatin adhering to the plastic. Lave gently with warm water until the pigment images are developed completely, when they should be chilled in cold water and hung up to dry.

TRANSFER TO SOLUBLE TEMPORARY SUPPORT

The simplest way to register the three coloured images is to assemble them on Autotype Soluble Temporary Support No. 214. This paper should be placed in a dish of water at between 70° and 80° F. until its coating feels slimy. It should then be removed from the water and squeegeed on to the cyan image previously immersed in cold water for one minute. This sandwich should then be dried so that the temporary support, now bearing the cyan image, can be stripped away from the plastic. This support paper should now be soaked again in cold water and squeegeed in register with the magenta image on its plastic support.

Registration is very simply achieved as the images can be seen clearly through the transparent plastic and while still wet can be moved into register. This sandwich should be dried, the temporary support and the cyan and magenta images stripped away, and the process repeated with the yellow image.

FINAL SUPPORT

The picture now produced will have the yellow image on the top and will be reversed from left to right. The temporary support should be re-soaked and squeegeed into contact with a piece of Autotype Single Transfer Paper, for example No. 116. This sandwich should be allowed to dry and then immersed in warm water so as to melt the coating of the soluble temporary support paper.. The soluble temporary support can then be peeled away leaving the finished Trichrome print on the Single Transfer Paper.

Full details of the improved Trichrome Carbro and allied processes will be found in the manual *Autotype Colour Printing Processes* published by the Autotype Company Ltd.

FORMULÆ

Many different formulæ have from time to time been recommended by different workers for carbro sensitising. The following solutions are those given by the manufacturers and can be considered standard formulæ. Either two baths or a single sensitizing bath may be used, the latter being more suited to large sizes, and commercial work requiring close control, where a mechanical squeegee is used. The two bath method is quite unsuited for mechanical squeegeeing as the time of immersion in the second bath is extremely critical. However, it is the cheaper of the two methods and gives more brilliant results.

Two Bath Method

Stock Solution A		
Potassium Ferricyanide ...	1 oz.	50 gm.
Potassium Bromide	1 oz.	50 gm.
Distilled Water to	10 oz.	500 c.c.
Stock Solution B		
Potassium Bichromate ...	180 gr.	18 gm.
Chromic Acid	40 gr.	4 gm.
Chrome Alum	100 gr.	10 gm.
Distilled Water to	10 oz.	450 c.c.

The working baths are made up as follows:

No. 1 *Working Bath*

Stock Solution A		1 part
Water		4 parts

No. 2 *Working Bath*

Stock Solution B	... ...	1 part
Water	... ...	4 parts

In order to get even sensitising sufficient of each of these baths should be used to cover the pigment paper fully. The No. 1 bath may be used for a considerable number of prints but the No. 2 bath should be renewed after each set. They should be used at a temperature of 60° to 65° F., the lower being preferable. The tissues should be immersed in the No. 1 bath for 2 minutes at 60° F., then squeegeed on to a sheet of glass to remove the surplus solution. The time of immersion in the No. 2 bath controls the contrast of the image, 25 seconds is an average time, but shorter gives more contrast and longer less.

Single Bath Method

Stock Solution A

Potassium Bichromate	1 oz.	10 gm.
Potassium Ferricyanide	1 oz.	10 gm.
Potassium Bromide ...	1 oz.	10 gm.
Distilled Water to ...	20 oz.	200 c.c.

Stock Solution B

Glacial Acetic Acid	1 oz.	10 c.c.
Hydrochloric Acid (pure) ...	1 oz.	10 c.c.
Formaldehyde 40%	22 oz.	220 c.c.

Working Bath

Stock Solution A	1 oz.	10 c.c.
Stock Solution B	1 drm.	1.25 c.c.
Water	7 oz.	70 c.c.

The Stock Solution B should be added to Stock Solution A just before the pigment paper is immersed, making certain that the two solutions are well mixed. The correct time of immersion is 3 minutes at 60° F.

Buffer Solution

Solution A

Di-sodium hydrogen phosphate	23.88 gm.
Water	1 litre

Solution B

Potassium di-hydrogen phosphate	9.08 gm.
Water	1 litre

For use take 25 c.c. of Solution B and 12.33 c.c. of Solution A which gives a solution of pH 6.5. The mixture may be diluted to 50 c.c. without any change in the pH.

NEGATIVE-POSITIVE PROCESSES

Agfacolor Negative

(Agfa Ltd., Deer Park Road. Wimbledon Factory Estate, London, S.W.19)

Agfacolor Negative film is a multilayer material with immobile couplers in each of the three emulsion layers which, when suitably processed, generate dyestuffs of the appropriate colour. Agfacolor is not developed by reversal, the only developer used is the colour-forming one, and so a colour negative, which has both tones and hues complementary to the original subject, results. The silver is removed from the film during processing and the final negative image consists of dyes only.

The colour negatives are printed, in a similar fashion to black and white photographs, either by contact or enlargement, on paper coated with three emulsions giving coloured images when developed in a coupling type developer.

Alternatively positive prints can be made on films coated with the three positive emulsions. In this way transparency positives of any desired size can be made. Similar equipment and precautions are obviously necessary when printing on this material as when printing on Agfacolor paper.

EXPOSURE

Two types of Agfacolor Negative film are made, in flat film, 35-mm., and size 20 rollfilm, one for use in daylight, the other for artificial light of colour temperature 3200° K. The speed of both of these types of film is 23° B.S. Log. or 16 B.S. and A.S.A. Arith. This corresponds to approximately 24° Scheiner or Weston 10. No colour correcting filters of any type must be used over the camera lens.

PROCESSING

The processing of Agfacolor Negative and Positive materials cannot be undertaken by the photographer unless he has undertaken a course of instruction at an approved Agfacolor School. The exposed films can, however, be sent to one of the processing stations selected by the manufacturers. In Britain there are five of these:—

Jones and Bailey Ltd., 70-72 Brewery Road, London, N.7.
Fencolor Laboratory, 11a Newmarket Road, Cambridge.
Tempo Laboratories Ltd.. St. John's Road, Tunbridge Wells, Kent.
Turners (Colorfoto) Ltd., Pink Lane, Newcastle-on-Tyne.
Lyall G. Smith, 8 Terenure Road East, Rathgar, Dublin, Eire.

Courses of instruction may be taken at the International School of Colour Photography, Heath House, Crockham Hill, Edenbridge, Kent. Agfacolor processing will also be undertaken by Colour Processing Laboratories Ltd., at the same address.

Gevacolor Negative

(Gevaert Ltd., Acton Lane, Harlesden, London, N.W.10)

Gevacolor Negative is an integral tripack containing colour couplers in each emulsion layer, and is developed in a colour developer to give negatives of complementary hues to the original subject. The final colour negative consists of dye images only since the silver negative image is removed during processing. These colour negatives are printed on Gevacolor paper, which is a similar integral tripack of correct contrast characteristics coated on a paper base.

EXPOSURE

Two types of Gevacolor Negative film are made in flat film, 35-mm. film and size 20 rollfilm, one for use in daylight and the other for artificial light of colour temperature 3200° K. The speed of both these types is 23° B.S. Log or 16 B.S. and A.S.A. Arith. This corresponds to approximately 24° Scheiner or 10 Weston.

PROCESSING

At the present time the processing of Gevacolor negative and positive materials can not be undertaken by the photographer but the exposed film should be sent to Gaycolor Ltd., 72 Wardour Street, London, W.1.

Pakolor

(Associated British-Pathe Ltd., Pathe House, 133-135 Oxford Street, London, W.1)

Pakolor Negative Film is a colour-coupler containing monopack designed for processing in a colour developer to produce colour negatives directly. The original silver images along with which the dye images are formed are removed in processing with a combined fixer and silver-bleach; hence the final image, which is complementary in both hue and tone to the original subject, consists of dye only.

The colour negatives which are produced in this way are printed on to paper coated with a similar monopack of three colour sensitive and colour forming emulsions and thus a colour print of correct tone and hue relationship results.

As is usual with processes of this type some care and some special equipment are required in processing and printing the film and paper and so at the present time these steps can only be undertaken in the laboratories specified by the distributors.

EXPOSURE

Two types of Pakolor negative film are made, in flat film, 35-mm. film and size 20 rollfilm, one for use in daylight the other for artificial light of colour temperature 3200° K. The speed of both these types is 21° B.S. Log. or 10 B.S. and A.S.A. Arith. This corresponds to approximately 22° Scheiner or 8 Weston.

PROCESSING

At the present time the processing of Pakolor negative and positive materials cannot be undertaken by the photographer but the exposed film should be sent to any one of the following four laboratories: Caithness (Color Photos) Ltd., 100 Loughborough Road, Kirkaldy, Fifeshire; Eucryl Colour Film Laboratories, Oakley Road, Shirley, Southampton; Millscolor, 69a Saddler Street, Durham; J. P. Roche & Co. Ltd., 50 Lower O'Connell Street, Dublin, Eire.

MATERIALS FOR MEDICAL PHOTOGRAPHY

GEVAERT SENSITIVE MATERIAL CHARACTERISTICS FOR MONOCHROME (STILL) MEDICAL PHOTOGRAPHY

Sensitive Material	Recommended meter settings: Weston Rating		B.S. (log)		Colour Sensitivity	Developer* recommended	Contrast	Degree of Grain
	Day	H.W.	Day	H.W.				
Gevachrome 32 plate	80	40	31°	28°	Yellow, Blue	1, 4, 5	Medium	Normal
Gevachrome roll film	50	24	29°	26°	Yellow, Blue	1, 5	Medium	Normal
Gevachrome cut film	80	40	31°	28°	Yellow, Blue	3, 4, 5	Medium	Normal
Gevapan 27 (Microgran) 35-mm. film	24	16	26°	24°	Red, Yellow, Blue	2, 6	Medium	Extra Fine
Gevapan 30 roll film	50	32	29°	27°	Red, Yellow, Blue	1, 5	Medium	Fine
Gevapan 30 35-mm. film	50	32	29°	27°	Red, Yellow, Blue	1, 5	Medium	Fine
Gevapan 30 cut film	50	32	29°	27°	Red, Yellow, Blue	3, 4, 5	Medium	Fine
Gevapan 33 roll film	100	64	32°	30°	Red, Yellow, Blue	1, 5	Medium	Normal
Gevapan 33 35-mm. film	100	64	32°	30°	Red, Yellow, Blue	1, 5	Medium	Normal to coarse
Gevapan 33 cut film	100	64	32°	30°	Red, Yellow, Blue	3, 5	Medium	Normal
Gevapan 30 plate	50	32	29°	27°	Red, Yellow, Blue	1, 6	Medium	Fine
Normal cut film					Blue	3	Medium	Fine
Diapositive Normal plate					Yellow, Blue	3	Medium	Fine
Diapositive Contrast plate					Yellow, Blue	3	High	Fine

* 1=Gevaert formula G.206. 2=Gevaert formula G.224. 3=Gevaert formula G.214. 4=Gevaert formula G.215. 5=Johnson Constant Endura. 6=Johnson Fine Grain.

GEVAERT SENSITIVE MATERIALS FOR MONOCHROME (STILL) MEDICAL PHOTOGRAPHY

Subject	Cut Film	Plates	Roll Film	35-mm. Film
Average skin conditions	Gevachrome	Gevachrome	Gevachrome	Gevapan 27
Skin conditions, with slight red or yellow surface markings...	Gevachrome	Superchrom Gevachrome	Gevachrome	Gevapan 27
Patients: nude, full-length or half-length to show posture or skeletal characteristics	Gevapan 33, 30	Gevapan 30 Gevapan 33	Gevapan 33, 30	Gevapan 33, 30
Portraits	Gevapan 33, 30	Ge.apan 30 Gevapan 33	Gevapan 33, 30	Gevapan 33, 30
Treated specimens	Gevapan 33, 30	Gevapan 30 Gevapan 33	Gevapan 33, 30	Gevapan 33, 30
Fresh specimens, with vivid bright colours of red, yellow, blue and brown	Gevapan 33, 30	Gevapan 30 Gevapan 33	Gevapan 33, 30	Gevapan 33, 30
Operating-theatre surgery	Gevapan 33	Gevapan 33	Gevapan 33	Gevapan 33
X-ray intermediates	Normal, Process	Diapositive Normal Diapositive Contrast	—	—
Copying half-tone monochrome subjects	Process Extra-Ortho	Process Extra-Ortho	—	—
Copying half-tone coloured subjects	Gevapan film Gevapan 30	Process Extra pan	—	—
Copying monochrome line subjects	Process Extra-Ortho	Process Extra-Ortho	—	—
Copying coloured line subjects	Gevapan film Gevapan 30	Process Extra pan	—	—
Infra-red photography of live subjects and specimens, to show veins, subcutaneous conditions, etc.	—	Infra-red	—	—

No filter is required for use with Gevachrome. No filter is required for use with Gevapan on normal subjects, but use appropriate filter to emphasise desired colours on special subjects.

ILFORD SENSITIVE MATERIALS CHARACTERISTICS FOR MONOCHROME (STILL) MEDICAL PHOTOGRAPHY

Sensitive Material	Colour Sensitivity	Speed	B.S./A.S.A. (log) Exposure Index		Weston Rating		Contrast	Graininess	Developer
			H.W.	Daylight	H.W.	Daylight			
N.50 Thin Film Half-Tone (P)	Non-colour sensitised (Sensitive to ultra-violet and blue)	Slow	—	—	—	—	Very high	Very fine	ID-13
N5.50 Line (FF)		Slow	—	—	—	—	Very high	Very fine	ID-13
N.40 Process (P)		Slow	—	—	—	—	High	Very fine	ID-13
N8.40 Process (FF)		Slow	—	—	—	—	High	Very fine	ID-2
Fine Grain Safety Pos. (MF)		Slow	—	—	—	—	High	Very fine	ID-2
N.30 Ordinary (P)		Slow	10°	16°	0.8	3	Medium	Fine	ID-2 or ID-11
N8.30 Fine Grain Ordinary Series 2 (FF)		Slow	—	—	—	—	Medium	Fine	ID-2 or ID-11
Special Rapid (P)		Slow	15°	21°	2.5	10	Medium	Fine	ID-2 or ID-11
Selochrome (FF.RF) ...	Ortho. Sensitive to ultra-violet, blue and green	Fast	27°	30°	40	80	Medium	Medium	ID-2 or ID-11
Orthotone (P)		Very fast	28°	31°	50	100	Medium	Medium	ID-2 or ID-11
Hyperchromatic (FF) ...		Ext. fast	31°	34°	100	200	Med. to low	Coarse	ID-2 or ID-11
R.50 Thin Film Half-Tone Pan (P)	Panchromatic (Sensitive to ultra-violet, blue, green and red)	Slow	—	—	—	—	Very high	Very fine	ID-13
R5.50 Panchro-line (FF) ...		Slow	—	—	—	—	Very high	Ext'y fine	ID-13
Micro-neg. Pan (FF) ...		Slow	—	—	—	—	Very high	Ext'y fine	ID-2
R.40 Rapid Process Pan (P)...		Medium	—	—	—	—	High	Fine	ID-13 or ID-2
R.20 Special Rapid Pan (P)...		Medium	23°	25°	16	25	Med. to High	Medium	ID-2 or ID-11
R.10 Soft Gradation Pan (P)		Fast	26°	28°	32	50	Medium	Medium	ID-2 or ID-11
Pan F (MF)		Medium	21°	23°	10	16	Med. to High	Very fine	ID-11
FP3 (RF.MF)		Medium	28°	29°	50	64	Medium	Fine	ID-11 or ID-48
HP3 (P)		Ext. fast	33°	34°	160	200	Medium	Medium	ID-2 or ID-11
HP3 (FF.RF)		Ext. fast	31°	32°	100	125	Medium	Medium	ID-2 or ID-11
HP3 (MF)		E t. fast	31°	32°	110	125	Medium	Medium	ID-11 or ID-48
HPS (P)		Ext. fast	36°	37°	320	400	Soft	Moderate	ID 2, PFP, or Contrast FF
HPS (FF) ...		Ext. fast	36°	37°	320	400	Soft	Moderate	ID-2, PFP, or ID-11

P—Plate. FF—Flat Film. RF—Roll Film. MF—35-mm. Film.

ILFORD SENSITIVE MATERIALS FOR MONOCHROME (STILL) MEDICAL PHOTOGRAPHY

Subject	Plates	Cut film	Roll film	35-mm. film
Average skin conditions ... ... Skin conditions with slight red or yellow surface markings	Selochrome Orthotone	Selochrome Hyperchromatic	Selochrome HP3*	HP3* FP3* Pan F*
Patients: full or half-length to show posture or skeletal characteristics	HPS HP3 R.10 Soft Gradation Pan	HPS HP3 FP3	HP3 FP3	HP3 FP3
Portraits	HPS HP3 R.10 Soft Gradation Pan	HPS HP3 FP3	HP3 FP3	HP3 FP3
Treated Specimens	R.20 Special Rapid Pan*	HPS* HP3* FP3*	HP3* FP3*	Pan F*
Fresh Specimens, with vivid bright colours of red yellow, blue and brown	R.20 Special Rapid Pan*	HPS* HP3* FP3*	HP3* FP3*	Pan F*
Operating-theatre surgery	HPS HP3	HPS* HP3	HP3	HP3
X-ray intermediates	N.30 Ordinary	N8.30 Fine Grain Ordinary Series 2	Selochrome HP3 FP3	Pan F
Copying continuous tone black and white subjects ...	N.30 Ordinary Special Rapid	N8.30 Fine Grain Ordinary Series 2	Selochrome HP3 FP3	Pan F FP3
Copying continuous tone coloured subjects	R.20 Special Rapid Pan	HPS HP3 FP3	HP3 FP3	Pan F
Copying black and white line subjects	N.50 Thin Film Half Tone N.40 Process	N5.50 Line N8.40 Process	—	Fine Grain Safety Pos. Micro-neg. Pan
Copying coloured line subjects	R.50 Thin Film Half Tone Pan R.40 Rapid Process Pan	R5.50 Panchro-line	—	Pan F

*With appropriate filter.

KODAK SENSITIVE MATERIAL CHARACTERISTICS FOR MONOCHROME (STILL) MEDICAL PHOTOGRAPHY

Sensitive Material	B.S./A S.A. Exposure Index Numbers to Tungsten Log.	to Tungsten Arith.	to Daylight Log.	to Daylight Arith.	Colour Sensitivity	Developer recommended	Contrast	Graininess
Plates:								
P.2000	37°	400	38°	500	Pan	D.61a, D.76, Quick Finish	Med.-high	Medium
P.1200	33°	160	34°	200	Pan	D.61a, D.76, Microdol, Quick Finish	Medium	Medium
P.300	24°	20	25°	25	Pan	D.61a D.76, Microdol	Med high	Fine
P.200	—	—	—	—	Pan	D.8, D.158, Maximum Contrast, Kodaline	Very high	Fine
P.25	—	—	—	—	Pan	D.8, D.158, Maximum Contrast, Kodaline	Very high	Very fine
O.800	26°	32	29°	64	Ortho	D.61a, D.76, Microdol, Quick Finish	Medium	Medium
O.250	16°	3	20°	8	Ortho	D.61a, D.76, Microdol, D.19b	Med.-high	Fine
B.40	—	—	—	—	Blue	D.76, D.61a, D.19b	Medium	Fine
IR ER. (with Wratten filter No 88A)	21°	10	19°	6	Infra-red	D.19b	Medium	Medium
Sheet film:								
Super Panchro Press ...	29°	64	31°	100	Pan	D.61a, D.76, Microdol, Quick Finish	Medium	Medium
Super-XX	29°	64	31°	100	Pan	D.61a, D.76, Microdol, Quick Finish	Soft	Medium
Panatomic-X	24°	20	26°	32	Pan	D.61a, D.76, Microdol, Quick Finish	Medium	Very fine
Kodaline Panchromatic	—	—	—	—	Pan	D.8, D.158, Maximum Contrast, Kodaline	Very high	Very fine
Ortho-X ...	29°	64	32°	125	Ortho	D.61a, D.76, Microdol	Soft	Medium
Commercial Ortho ...	20°	8	25°	25	Ortho	D.61a, D.76, Microdol	Medium	Fine
Commercial Fine Grain	17°	4	24°	20	Blue	D.61a, D.76, Microdol	Medium	Fine
Process	—	—	—	—	Blue	D.158, D.76	High	Fine
Roll films:								
Super-XX	29°	64	31°	100	Pan	D.76, Microdol, D.61a	Medium	Medium
Plus-X	26°	32	28°	50	Pan	D.76, Microdol, D.61a	Medium	Medium
Panatomic-X	24°	20	26°	32	Pan	D.76, Microdol, D.61a	Medium	Very fine
Verichrome	25°	25	28°	50	Ortho	D.76, Microdol, D.61a	Medium	Medium
Miniature films:								
Super-XX	29°	64	31°	100	Pan	D.76, Microdol	Soft	Medium
Plus-X	27°	40	29°	64	Pan	D.76, Microdol	Medium	Fine
Panatomic-X	24°	20	26°	32	Pan	D.76, Microdol	Medium	Very fine
Micro-File Pan ...	14°	2	15°	2.5	Pan	D.158, Kodaline / D.76 (1 + 2 or 1 + 4)	High / Medium	Ext'y fine
Safety Positive ...	7°*	0.4*	—	—	Blue	D.163, D.76	Medium	Very fine

*These figures are for use when copying; they are based on an exposure meter reading obtained from a white surface in the copying position.

KODAK SENSITIVE MATERIALS FOR MONOCHROME (STILL) MEDICAL PHOTOGRAPHY

Subject	Sheet Film	Plates	Roll Film	35 mm. Film
Average skin conditions	Comm. Ortho Ortho-X Panatomic-X Super-XX	O.250 O.800 P.1200 P.300	Panatomic-X Plus-X Super-XX Verichrome	Panatomic-X
Skin conditions with slight red or yellow surface markings	Comm. Ortho Ortho-X	O.250 O.800	Verichrome	Pana omic-X, with Wratten 38 or 66 filter
Patients: nude, full or half-length to show posture or skeletal characteristics	Comm. Ortho Ortho-X	O.250 O.800	Verichrome	Plus-X
Portraits	Comm. Ortho Ortho-X	O 250 O.800	Verichrome	Panatomic-X
Treated specimens...	Comm. Ortho Panatomic-X	O.250 P.300	Panatomic-X Verichrome	Panatomic-X
Fresh specimens, with vivid colours of red, yellow, blue and brown	Panatomic-X	P.300	Panatomic-X Plus-X	Panatomic-X
Operating-theatre surgery	Super-XX	P.1200	Super-XX	Super-XX
X-ray intermediates	Comm. Fine Grain	O.250	—	Panatomic-X
Copying continuous-tone monochrome subjects ...	Comm. Fine Grain	B.40 O.250	Verichrome Panatomic-X	Panatomic-X
Copying continuous-tone coloured subjects	Panatomic-X	P.300	Panatomic-X	Panatomic-X
Copying monochrome line subjects	Process	B.40 B.20	—	Safety positive
Copying coloured line subjects	Kodaline Pan	P.25	—	—
Infra-red photography of live subjects and specimens to show veins, subcutaneous conditions, etc. ...	—	III-R IR.ER	—	—

The use of a filter depends on the particular subject and the effect required, and needs specific decision in each case. With panchromatic material and tungsten lighting the Wratten filter No. 11 (XI) gives correct tonal rendering.

COLOUR MATERIALS FOR STILL PHOTOGRAPHY

(Reprinted from *The British Journal of Photography*, 4th September, 1953.

The films which are listed on the following pages comprise, so far as is known, an accurate and complete list of the colour materials which are available throughout the world today. Only camera materials for still photography are included, thus sheet film for duplicate transparencies such as Ansco 638 and motion picture release positive such as Du Pont 275 are not included.

Ansco Plenacolor, a negative material with couplers in the emulsion layers, has not been included since this film is not at the moment generally available in the United States, although it has been given a limited area distribution for evaluation.

The materials are listed in alphabetical order and the essential details are given under the separate headings. The classifications are those in common use, the basic subdivision being additive and subtractive materials. This basic division is then further subdivided into reversal and negative-positive systems.

The subtractive materials are then divided into those films which have the colour couplers contained within the emulsion layers and those which incorporate the couplers into the developers. As a final breakdown the coupler-in-emulsion materials are classified as either of the Agfa type in which the coupler is rendered non-diffusing by having a long hydro-carbon chain attached to the molecule, or the Kodak type in which the coupler is dispersed in a water-insoluble, water-permeable natural or synthetic resin.

The types of illumination which the films are basically balanced for are shown in two columns under daylight or tungsten beadings with the manufacturer's type designation for each shown first for each film. The colour temperature for which the tungsten type is balanced is then given. The speed ratings are in all cases those claimed by the manufacturer, converted where necessary into one of the three standard methods of speed rating used in the United States, Britain and Germany. The rating shown in Roman type is that of the manufacturer, those shown in italic are the author's own conversion.

Name of Material	Country of Manu-facture	Type of Material	Sizes Available	Sensitisations and Speeds		Processing	Manufacturer
				Daylight	Tungsten		
Aero Ektachrome	U.S.A.	Subtractive reversal monopack. Couplers in emulsions, dispersed in water-insoluble water-permeable material.	Aerial camera rolls only.	ASA 25 *BSI 25°* *DIN 16/10*	Not available.	Kits available.	Eastman Kodak Co., 343 State St., Rochester 4, New York, U.S.A.
Agfacolor Negative	Germany (West Zone)	Subtractive negative monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 120 and 620 roll-film. Sheet film.	Type T *ASA 16* *BSI 23°* DIN 14/10	Type K 3200° K *ASA 16* *BSI 23°* DIN 14/10	Manufacturer's specified laboratories. User-processing after instruction course of manufacturer.	Agfa Aktiengesellschaft, Leverkusen, Bayerwerk, Germany.

COLOUR MATERIALS FOR STILL PHOTOGRAPHY

Name of Material	Country of Manu-facture	Type of Material	Sizes Available	Sensitisations and Speeds		Processing	Manufacturer
				Daylight	Tungsten		
Agfacolor Negative	Germany (East Zone)	Subtractive negative monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 120 and 620 roll-film. Sheet film.	Type T *ASA 12* *BSI 22°* DIN 13/10	Type K 3200° K *ASA 12* *BSI 22°* DIN 13/10	User processing; and independent laboratories.	Filmfabrik Agfa (Photoplenka), Kreis Bittefeld, Wolfen, Germany.
Agfacolor Reversal	Germany (West Zone)	Subtractive reversal monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 120 and 620 roll-film.	Type T *ASA 20* *BSI 24°* DIN 15/10	Type K 3200° K *ASA 20* *BSI 24°* DIN 15/10	Manufacturer's laboratories.	Agfa Aktiengesellschaft, Leverkusen, Bayerwerk, Germany.
Agfacolor Reversal	Germany (East Zone)	Subtractive reversal monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 120 and 620 rolls.	Type T *ASA 12* *BSI 22°* DIN 13/10	Type K 3200° K *ASA 12* *BSI 22°* *DIN 13/10*	Manufacturer's laboratories.	Filmfabrik Agfa (Photoplenka), Kreis, Bittefeld, Wolfen, Germany.
Alticolor	France	Additive reversal film. Irregular filter mosaic.	120 and 620 roll (for 8 exp. 6×6 cm.).	Type A ASA 10 *BSI 21°* DIN 12/10	Not available.	Manufacturer's laboratories.	Société Lumière, 25 Rue du 4 Septembre, Paris (2c). France.
Ansco Color	U.S.A.	Subtractive reversal monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 120 and 620 rolls. Sheet film.	Daylight type. ASA 12 *BSI 22°* *DIN 13/10* Sheet film	Tungsten type 3200° K ASA 12 *BSI 22*(°) *DIN 13/10* ASA 10	Independent laboratories. Amateur and professional size kits available.	Ansco, Binghamton, New York, U.S.A.
Chromart-Tricolor Negative Film	England[1]	Subtractive negative monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	$3\frac{1}{4}\times4\frac{1}{4}$ in. and 4×5 in. sheet film only.	Not available.	Tungsten 3400° K *ASA 16*[2] *BSI 23°* *DIN 14/10*	Manufacturer's laboratory only.	Anglo-American Colour Photographic Industries Ltd., 30 Queen's Grove, London, N.W.8.

1 This material is believed to be actually manufactured in Switzerland by Tellko and is probably identical with the material listed under Telcolor.

2 Manufacturer's speed rating 12 Weston.

COLOUR MATERIALS FOR STILL PHOTOGRAPHY

Name of Material	Country of Manufacture	Type of Material	Sizes Available	Sensitisations and Speeds: Daylight	Sensitisations and Speeds: Tungsten	Processing	Manufacturer
Dufaycolor	Great Britain	Additive reversal film. Regular filter mosaic.	35 mm., 127, 120 and 620 rolls. Sheet film.	Type D1 *ASA 8* BSI 20° *DIN 11/10*	Type D2 and D4 *ASA 8* BSI 20° *DIN 11/10* Sheet film only. Filter needed for all artificial light sources.	Manufacturer's specified laboratory. Formulae published and kits available.	Dufay Ltd., Boreham Wood, Hertfordshire, England.
Ektachrome	U.S.A.	Subtractive reversal monopack. Couplers in emulsions, dispersed in water-insoluble water-permeable material.	120 and 620 rolls. Sheet film.	Daylight ASA 8 *BSI 20°* *DIN 11/10*	Type B 3200° K ASA 10 *BSI 21°* *DIN 12/10*	Independent laboratories. Professional and amateur size kits available.	Eastman Kodak Co., 343 State St., Rochester 4, New York, U.S.A.
Ektacolor	U.S.A.	Subtractive negative monopack. Couplers in emulsions, dispersed in water-insoluble water-permeable material. Automatic masking by coloured couplers.	Sheet film only.	Not available.	Type B 3200° K ASA 8 *BSI 20°* *DIN 11/10*	Professional size kits available.	Eastman Kodak Co., 343 State St., Rochester 4, New York, U.S.A.
Ferraniacolor Negative	Italy	Subtractive negative monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 120 and 620 rolls. Sheet film.	Daylight type ASA 12 *BSI 22°* DIN 13/10	Artificial light type ASA 12 *BSI 22°* DIN 13/10	Manufacturer's laboratory. Professional photographers.	Ferrania S.P.A., Corso Matteotti 12, Milan, Italy.

COLOUR MATERIALS FOR STILL PHOTOGRAPHY

Name of Material	Country of Manufacture	Type of Material	Sizes Available	Sensitisations and Speeds: Daylight	Sensitisations and Speeds: Tungsten	Processing	Manufacturer
Ferraniacolor Reversal	Italy	Subtractive reversal monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., and 120 rolls. Sheet film.	Daylight ASA 20 *BSI 24°* *DIN 15/10*	Not available.	Manufacturer's laboratories. Amateur and professional processing kits available in U.K.	Ferrania S.P.A., Corso Matteotti 12, Milan, Italy.
Filmcolor	France	Additive reversal film. Irregular filter mosaic.	Sheet film only.	Type A *ASA 10* *BSI 21°* *DIN 12/10*	Not available.	Manufacturer's laboratory and professional photographers.	Société Lumiérè, 25 Rue du 4 Septembre Paris, (2e) France.
Fujicolor	Japan	Subtractive reversal monopack. Couplers in developers.	35 mm. and 120 roll (4 exp.). Sheet film (5×4 in.).	Daylight ASA 10 *BSI 21°* *DIN 12/10*	Tungsten 3200° K ASA 10 *BSI 21°* *DIN 12/10* Available only on request for motion-picture use.	Manufacturer's laboratory only.	Fuji Film Industry Co. Ltd., 3 3-chome Ginza, Chuo-ku, Tokyo City, Japan.
Gevacolor Negative	Belgium	Subtractive negative monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 120 and 620 rolls.	ASA 16 BSI 23° DIN 14/10	Not available.	Manufacturer's specified laboratories.	Gevaert Photographic Products, S.A. Mortsel, Antwerp, Belgium.
Gevacolor Reversal	Belgium	Subtractive reversal monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 127, 120 and 620 rolls.	Type R5 ASA 12 *BSI* 22° DIN 13/10	Type R3 3200° K ASA 12 *BSI 22°* DIN 13/10	Manufacturer's specified laboratories.	Gevaert PhotographicProducts, S.A. Mortsel, Antwerp, Belgium.

COLOUR MATERIALS FOR STILL PHOTOGRAPHY

Name of Material	Country of Manufacture	Type of Material	Sizes Available	Sensitisations and Speeds		Processing	Manufacturer
				Daylight	Tungsten		
Ilford Colour Film	England	Subtractive reversal monopack. Couplers in developers.	35 mm. rolls only.	Type D *ASA 10*[3] *BSI 21°* *DIN 12/10*	Not available.	Manufacturer's laboratory only.	Ilford Ltd., Ilford, London, England.
Johnsons Colour Screen Process.	England	Additive negative-positive process. Separable regular mosaic screen plate. Positive bound up with similar screen plate.	Regular plate sizes from 3½ × 2½ in. to 10 × 8 in.	Depends on speed of regular black and white type plate used. With fastest material average rating is ASA 25 to daylight, ASA 12 to tungsten.		Normal black and white processing.	Johnsons of Hendon Ltd., Hendon Way, London, N.W.4, England.
Karat Color Film	U.S.A.	Subtractive reversal monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue[4].	35 mm. rolls only.	Daylight ASA 12 *BSI 22°* *DIN 13/10*	Tungsten 3200° K ASA 12 *BSI 22°* *DIN 13/10*	Manufacturer's laboratory only.	Karat Films Inc., 330 Jefferson St., Hoboken 4, New Jersey, U.S.A.
Kodachrome	U.S.A., England, France	Subtractive reversal monopack. Couplers in developers.	35 mm. rolls only.	Daylight ASA 10 BSI 21° *DIN 12/10*	Type A 3400° K ASA 16 BSI 23° *DIN 14/10*	Manufacturer's laboratories only.	Eastman Kodak Co., 343 State St., Rochester 4 New York, U.S.A. Kodak Ltd., Kingsway, London, W.C.2, England. Kodak-Pathe S.A., 37 Rue Francois Ier., Paris (8e), France.
Kodacolor	U.S.A.	Subtractive negative monopack. Couplers in emulsions, dispersed in water-insoluble, water-permeable material. Automatic masking by coloured couplers.	127, 120, 620, 116, 616 rolls only.	Daylight ASA 25 *BSI 25°* *DIN 16/10*	Type A 3400° K ASA 20 *BSI 24°* *DIN 15/10*	Manufacturer's laboratory only.	Eastman Kodak Co., 343 State St., Rochester 4, New York, U.S.A.

[3] **Manufacturer's speed rating 8 Weston.**
[4] **This material** is believed to be Ansco Color material repackaged.

COLOUR MATERIALS FOR STILL PHOTOGRAPHY

Name of Material	Country of Manufacture	Type of Material	Sizes Available	Sensitisations and Speeds		Processing	Manufacturer
				Daylight	Tungsten		
McGregor Color Film	U.S.A.	Subtractive reversal monopack. Couplers in developers.	35 mm. rolls only.	Outdoor ASA 10 *BSI 21°* *DIN 12/10*	Indoor 3400° K ASA 16 *BSI 23°* *DIN 14/10*	Manufacturer's laboratory only.	McGregor Products Co., 16 State St., Rochester 14, New York, U.S.A.
Multichrome	England	Subtractive reversal monopack. Couplers in emulsions, dispersed in water-insoluble water-permeable material[5].	127, 120 and 620 rolls.	Daylight *ASA 20*[6] *BSI 24°* *DIN 15/10*	Not available.	Manufacturer's laboratory only.	Hansard Photographic Laboratories Ltd., Westfield, Tiverton, Devon, England.
Oriental Color Film Negative	Japan	Subtractive negative monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm. and 120 rolls (6 exp.) only.	Daylight type ASA 12 *BSI 22°* *DIN 13/10*	Artificial light type. 3200° K ASA 12 *BSI 22°* *DIN 13/10*	Manufacturer's laboratory and processing kits available.	Oriental Photo Industry Co. Ltd., 5 7-chome Ginza Chuo-ku, Tokyo City, Japan.
Oriental Color Film Reversal	Japan	Subtractive reversal monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm. and 120 rolls (6 exp.) only.	Daylight type ASA 16 *BSI 23°* *DIN 14/10*	Artificial light type 3200° K ASA 16 *BSI 23°* *DIN 14/10*	Manufacturer's laboratory and processing kits available.	Oriental Photo Industry Co. Ltd., 5 7-chome Ginza, Chuo-ku, Tokyo City, Japan.
Pakolor	England	Subtractive negative monopack. Couplers in emulsions immobilised by long-chain hydrocarbon residue.	35 mm., 120, and 620 rolls. Sheet film.	Type D *ASA 10*[7] *BSI 21°* DIN 12/10	Type A 3200° K *ASA 10* BSI 21° *DIN 12/10*	Manufacturer's specified laboratories. Amateur and professional size kits available.	Associated British-Pathe Ltd. 133–135 Oxford St., London, W.1, England.

5 This material contains couplers of the Kodak type and is probably Aero Ektachrome slit and repackaged.
6 Manufacturer's speed rating 25° Scheiner.
7 Manufacturer's speed rating quoted as range, i.e. 10/10 to 12/10 DIN. Higher figure has been given.

COLOUR MATERIALS FOR STILL PHOTOGRAPHY

Name of Material	Country of Manufacture	Type of Material	Sizes Available	Sensitisations and Speeds		Processing	Manufacturer
				Daylight	Tungsten		
Sakura Color Film	Japan	Subtractive reversal monopack. Couplers in developers.	35 mm., and 120 rolls (6 exp.) only.	Daylight type ASA 10 *BSI 21°* *DIN 12/10*	Artificial light type 3200° K ASA 10 *BSI 21°* *DIN 12/10* Available only on request for motion-picture use.	Manufacturer's laboratory only.	Konishi Photo Industry Co. Ltd., 3 3-chome Muro-machi, Nihonbashi, Chuo-ku, Tokyo City, Japan.
Super-Tomic Color Film	U.S.A.	Subtractive reversal monopack. Couplers in emulsions, dispersed in water-insoluble, water-permeable material[8].	35 mm. rolls only.	Daylight ASA 125 *BSI 32°* *DIN 23/10*	Not available.	Manufacturer's laboratory only.	Super-Tomic Products Co., 6411 Hollywood Boulevard, Hollywood 28, California, U.S.A.
Telcolor Negative	Switzerland	Subtractive negative monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 120, and 620 rolls. Sheet film.	Universal type for daylight or artificial light. ASA 16 *BSI 23°* *DIN 14/10*	ASA 20 *BSI 24°* *DIN 15/10*	Manufacturer's specified laboratories only.	Tellko S.A., Fribourg, Switzerland.
Telcolor Reversal	Switzerland	Subtractive reversal monopack. Couplers in emulsions, immobilised by long-chain hydrocarbon residue.	35 mm., 120 and 620 rolls. Sheet film.	Daylight type ASA 16 *BSI 23°* *DIN 14/10*	Not available	Manufacturer's specified laboratories only.	Tellko S.A., Fribourg, Switzerland.

8 This material contains couplers of the Kodak type and is probably Aero Ektachrome slit and repackaged. The high speed rating is probably attained by extending the time of first development, the low contrast which this normally gives being compensated in some degree by the inherently higher-than-normal contrast of the aerial type film and the higher maximum density which this material normally attains.

SENSITIVE MATERIALS FOR MONOCHROME STILL PHOTOGRAPHY

For **Colour** Materials see p. 406.

For Narrow Gauge **Cine** Materials see p. 363.

The speed numbers tabulated below are speeds to daylight (except as otherwise stated) expressed in the Exposure Index System which has been adopted by the British Standards Institution and by the American Standards Association. No responsibility is accepted for the accuracy of these figures, but every care has been taken in compiling the tables, and in most cases the figures have been obtained direct from the manufacturers of the materials concerned.

The type of material is designated by the letters: P (plates); SF (sheet film); RF (roll film); and MF (35-mm. miniature film).

Colour sensitivity is indicated by the abbreviations: Pan (panchromatic); Ortho (orthochromatic); B (ordinary, or blue-sensitive); and I.R. (infra-red sensitive).

Where only DIN speeds, or in the case of certain process materials H. & D. speeds, are officially available, these only have been given. Approximate conversions from one speed system to another will be found on p. 422.

Manufacturer	Plate or Film	Type	Colour Sensitivity	Exposure Index log.	Exposure Index arith.	H. & D. Speed	DIN Speed
Adox (see Schleussner)							
Agfa (Leverkusen)	Isopan Portrait	SF	Pan	19°	64	—	20/10°
	Isopan F	SF	Pan	26°	32	—	17/10°
	Isopan ISS	RF	Pan	30°	80	—	21/10°
	Isopan F	RF	Pan	—	—	—	17/10°
	Isopan ISS	MF	Pan	—	—	—	21/10°
	Isopan F	MF	Pan	—	—	—	17/10°
	Isopan FF	MF	Pan	—	—	—	10/10°
Barnet	Soft Panchromatic	P	Pan	27°	40	—	—
	Special Rapid Pan	P	Pan	21°	10	—	—
	XL Super Speed Ortho ...	P	Ortho	25°	25	—	—
	Special Rapid	P	B	21°	10	—	—
	Rapid Pan Process	P	Pan	—	—	100	—
	Ordinary	P	B	—	—	100	—
	Fine Grain Ordinary Stripping	P	B	—	—	50	—
	Litho Process	P	Ortho	—	—	15	—
	Line Tone (Thin Film) Process	P	B	—	—	5	—
	Line Tone (Thin Film) Pan Process	P	Pan	—	—	25	—

Manu-facturer	Plate or Film	Type	Colour Sensitivity	Exposure Index log.	Exposure Index arith.	H. & D. Speed	DIN Speed
Crumière	Panchro P	P	Pan	29°	64	—	—
	Super Aviachrom	P	Ortho	28°	50	—	—
	Aviator	P	Ortho	25°	25	—	—
	Reproduction Ortho ...	P	Ortho	20°	8	—	—
	Reproduction...	P	B	15°	2.5	—	—
	Aviapan	SF	Pan	31°	100	—	—
	Super Ortho	SF	Ortho	28°	50	—	—
	Aviapan	RF	Pan	29°	64	—	—
	Aviapan	MF	Pan	29°	64	—	—
	Super Aviachrom	MF	Ortho	28°	50	—	—
Dufay	Super 100 Pan	RF	Pan	31°	100	—	—
	Ortho	RF	Ortho	28°	50	—	—
	Super 50 Pan	MF	Pan	28°	50	—	—
Ensign	Ultrachrome	RF	Ortho	26°	32	—	—
Ferrania	Super Panchro 32	SF	Pan	31°	100	—	—
	Super Panchro 28	SF	Pan	27°	40	—	—
	Ultrachromatic 30	SF	Ortho	29°	64	—	—
	Super Panchro 32	RF	Pan	31°	100	—	—
	Super Panchro 28	RF	Pan	27°	40	—	—
	Ultrachromatic 30	RF	Ortho	29°	64	—	—
	Super Panchro S2	MF	Pan	31°	100	—	—
	Super Panchro P3	MF	Pan	27°	40	—	—
	Ultrachromatic U2	MF	Ortho	29°	64	—	—
Gevaert	Gevapan 33	P	Pan	32°	125	—	—
	Gevapan 30	P	Pan	29°	64	—	—
	Gevapan 27	P	Pan	26°	32	—	—
	Superchrom	P	Ortho	30°	80	—	—
	Gevapan 33	SF	Pan	32°	125	—	—
	Gevapan 30 (Panchromosa)...	SF	Pan	29°	64	—	—
	Gevachrome 32	SF	Ortho	31°	100	—	—
	Gevapan 33	RF	Pan	32°	125	—	—
	Gevapan 30	RF	Pan	29°	64	—	—
	Gevapan 27 (Microgran) ...	RF	Pan	26°	32	—	—
	Gevachrome 30	RF	Ortho	29°	64	—	—
	Infra-red (with filter 719) ...	RF	I.R.	17°	4	—	—
	Gevapan 33	MF	Pan	32°	125	—	—
	Gevapan 30	MF	Pan	29°	64	—	—
	Gevapan 27 (Microgran) ...	MF	Pan	26°	32	—	—
	Dia-Direct 26 Pan	MF	Pan	25°	25	—	—
	Infra-red (with filter 719) ...	MF	I.R.	17°	4	—	—
Guilleminot	Panchroguil	P	Pan	34°	200	—	—
	Superfulgur	P	B	34°	200	—	—
	Panchro 66	P	Pan	32°	125	—	—
	Panchro 2000...	P	Pan	31°	100	—	—
	Panchro 200	P	Pan	27°	40	—	—
	Studioguil	P	Ortho	30°	75	—	—
	Anecra	P	Ortho	29°	60	—	—
	Infraguil	P	I.R.	28°	50	—	—
	Radio-eclair	P	B	24°	20	(white flame arc)	
				23°	16	(tungsten light)	

Manu-facturer	Plate or Film	Type	Colour Sensitivity	Exposure Index log.	Exposure Index arith.	H. & D. Speed	DIN Speed
Guilleminot (*continued*)	Helioguil	P	B	22°	120	(white flame arc)	
				21°	10	(tungsten light)	
	Graphobrom	P	Ortho	21°	10	(white flame arc)	
				20°	8	(tungsten light)	
	Collodium	P	B	16°	3	(white flame arc)	
				15°	2.5	(tungsten light)	
	Collodium Process	P	B	13°	1.6	(white flame arc)	
				12°	1.2	(tungsten light)	
	Studio Panchro	SF	Pan	31°	100	—	—
	Studio Ortho	SF	Ortho	28°	50	—	—
	Panchro 55	RF	Pan	29°	64	—	—
	Panchro 55 grain fin ...	RF	Pan	28°	50	—	—
	Super 44	RF	Ortho	28°	50	—	—
Hauff	Super Pancola	P	Pan	—	—	—	22/10°
	Pancola	P	Pan	—	—	—	20/10°
	Pancola Special Portrait ...	P	Pan	—	—	—	21/10°
	Pancrosin	P	Pan	—	—	—	17/10°
	Modula	P	Ortho	—	—	—	18/10°
	Analo-Flavin	P	Ortho	—	—	—	16/10°
	Ortho (Mikrosin)	P	Ortho	—	—	—	12/10°
	Lantern	P	B	—	—	—	3/10°
	Portrait	SF	Pan	—	—	—	21/10°
Ilford	HPS	P	Pan	37°	400	—	—
	HP3	P	Pan	34°	200	—	—
	FP4	P	Pan	30°	80	—	—
	R.10 Soft Gradation Panchromatic	P	Pan	28°	50	—	—
	R.20 Special Rapid Panchromatic	P	Pan	25°	25	—	—
	R.25 FP Special	P	Pan	27°	40	—	—
	Orthotone	P	Ortho	30°	80	—	—
	Selochrome	P	Ortho	30°	80	—	—
	G.30 Chromatic	P	Ortho	18°	5	—	—
	Zenith	P	B	25°	25	—	—
	Special Rapid...	P	B	21°	10	—	—
	N.25 Soft Ordinary	P	B	16°	3	—	—
	N.30 Ordinary	P	B	16°	3	—	—
	HPS	SF	Pan	37°	400	—	—
	HP3	SF	Pan	32°	125	—	—
	FP3	SF	Pan	29°	64	—	—
	Hyperchromatic	SF	Ortho	34°	200	—	—
	Selochrome	SF	Ortho	30°	80	—	—
	G8.30 Commercial Ortho ...	SF	Ortho	27°	40	—	—
	HP3	RF	Pan	32°	125	—	—
	FP3	RF	Pan	29°	64	—	—
	Selochrome	RF	Ortho	30°	80	—	—
	HP3	MF	Pan	32°	125	—	—
	FP3	MF	Pan	29°	64	—	—
	Pan F	MF	Pan	23°	16	—	—
Kodak	P2000	P	Pan	38°	500	—	—
	P1500 Lightning Pan Press ...	P	Pan	31°	100	—	—
	P1200 Super Panchro Press...	P	Pan	33°	160	—	—
	P300 Rapid Panchromatic ...	P	Pan	25°	25	—	—
	O800 Super Speed Orthochromatic	P	Ortho	29°	64	—	—
	O250 Rapid Orthochromatic Metallographic	P	Ortho	20°	8	—	—

Manufacturer	Plate or Film	Type	Colour Sensitivity	Exposure Index log.	Exposure Index arith.	H. & D. Speed	DIN Speed
Kodak (*continued*)	Super Panchro Press... ...	SF	Pan	31°	100	—	—
	Super-XX	SF	Pan	31°	100	—	—
	Panatomic-X	SF	Pan	26°	32	—	—
	Ortho-X	SF	Ortho	32°	125	—	—
	Commercial Ortho	SF	Ortho	25°	25	—	—
	Commercial Fine Grain ...	SF	B	17°	4	(to tungsten	light)
	Super-XX	RF	Pan	31°	100	—	—
	Plus-X	RF	Pan	28°	50	—	—
	Panatomic-X	RF	Pan	26°	32	—	—
	Verichrome	RF	Ortho	28°	50	—	—
Lumière	S.P.L.	P	Pan	29°	64	—	—
	Lumichrome	P	Ortho	28°	50	—	—
	S.S.E.	P	Ortho	27°	40	—	—
	Altipan	SF	Pan	31°	100	—	—
	Altichrome	SF	Ortho	30°	80	—	—
	Lumipan	SF	Pan	29°	64	—	—
	Altipan	RF	Pan	30°	80	—	—
	Lumipan G.F.	RF	Pan	28°	50	—	—
	Super-Lumichrome	RF	Ortho	27°	40	—	—
	Altipan	MF	Pan	30°	80	—	—
	Lumipan G.F.	MF	Pan	28°	50	—	—
	Super-Lumichrome	MF	Ortho	27°	40	—	—
Perutz	Superomnia	P	Pan	—	—	—	22/10°
	Portrait	P	Pan	—	—	—	21/10°
	Peromnia	P	Pan	—	—	—	19/10°
	Perchromo	P	Pan	—	—	—	17/10°
	Persenso	P	Ortho	—	—	—	20/10°
	Braunsiegel	P	Ortho	—	—	—	16/10°
	Silver Eosin	P	Ortho	—	—	—	12/10°
	Superomnia	SF	Pan	—	—	—	21/10°
	Portrait	SF	Pan	—	—	—	21/10°
	Peromnia	RF	Pan	—	—	—	21/10°
	Perpantic	RF	Pan	—	—	—	17/10°
	Persenso	RF	Ortho	—	—	—	18/10°
	Peromnia	MF	Pan	—	—	—	21/10°
	Perpantic	MF	Pan	—	—	—	17/10°
	35-mm. Reversal Miniature...	MF	Pan	—	—	—	15/10°
	Pergrano	MF	Pan	—	—	—	12/10°
Schleussuer	Adox PL21PM	SF	Pan	31°	100	—	—
	Adox PL21PT	SF	Pan	31°	100	—	—
	Adox R21P	RF	Pan	31°	100	—	—
	Adox R18P	RF	Pan	28°	50	—	—
	Adox R18O	RF	Ortho	28°	50	—	—
	Adox KB21	MF	Pan	31°	100	—	—
	Adox KB17	MF	Pan	27°	40	—	—
	Adox KB14	MF	Ortho	24°	20	—	—

KEEPING PROPERTIES AND USEFUL LIFE OF SOLUTIONS

Reprinted by kind permission of Kodak Limited, from the " Kodak " Photographic Handbook " ' Kodak ' Chemicals and Formulae"

KODAK FORMULA	KEEPING PROPERTIES at 65-70°F. of unused solutions prepared from formulae				USEFUL LIFE§ Number of 8 × 10 inch sheets processed for *standard time* in 160 fl. oz. without loss of quality	
	IN DISH	GALLON TANK	STOPPERED BOTTLE FULL	STOPPERED BOTTLE HALF FULL	IN DISH	NARROW DEEP TANK
Developers						
D-1	30 min.	3 hr.	1 month (in 3 solutions)	2 weeks (in 3 solutions)	12	24
D-8	4 hr.	N.R.	2 months	1 month	18	36
D-16	24 hr.	1 month	6 months	2 months	24	48*
D-16R	—	—	6 months	2 months	used as Replenisher only	
D-19b	24 hr.	1 month	6 months	3 months	36	72
D-19bR	—	—	6 months	3 months	used as Replenisher only	
D-23	24 hr.	1 month	6 months	2 months	24	36
D-25	24 hr.	1 month	6 months	2 months	20	30
D-25R	—	—	6 months	2 months	used as Replenisher only	
D-32	2 hr.	N.R.	2 months (in 2 solutions)	2 weeks (in 2 solutions)	18	N.R.
D-61a	24 hr.	2 weeks	2 months	3 weeks	18 (1:1)	36* (1:3)
D-61aR	—	—	2 months	3 weeks	used as Replenisher only	
D-72	24 hr.	2 weeks	3 months	1 month	24 (1:1) Negatives 18 (1:2) Negatives	48 (1:1) 36 (1:2)
D-76	24 hr.	1 month	6 months	2 months	24	36*
D-76R	—	—	6 months	2 months	used as Replenisher only	
D-82	2 hr.	24 hr.	1 week	2 days	12	24‡
D-156	6 hr.	N.R.	3 months	1 month	Exhaustion affects colour of image. Life depends upon quality required.	N.R.
D-158	24 hr.	1-2 weeks	3 months	1 month	24 (1:1) Negatives 36 (1:1) Prints	48 (1:1) —
D-163	24 hr.	1-2 weeks	3 months	1 month	15 (1:3) Negatives 36 (1:1) Prints 30 (1:3) Prints	30 (1:3) — —
D-166	8 hr.	N.R.	3 months	1 month	—	—
D-167	—	—	3 months (in 2 solutions)	2 months (in 2 solutions)	12	24

KEEPING PROPERTIES AND USEFUL LIFE OF SOLUTIONS—*Continued.*

D-170	30 min.	N.R.	3 weeks	N.R.	48	N.R.
D-173	10 hr.	N.R.	2 months	2 weeks	16 (1:2)	N.R.
D-177	30 min.	3 hr.	1 month (in 3 solutions)	2 weeks (in 3 solutions)	12	24
D-178	4 hr.	N.R.	2 months	1 month	18	36
DK-15	8 hr.	1 week	3 months	1 month	18	36
DK-20	24 hr.	1 month	6 months	2 months	24	36*
DK-20R	—	—	6 months	2 months	used as Replenisher only	
DK-50	24 hr.	1 month	6 months	2 months	24	48
Rinse and Hardening Baths						
SB-1	3 days	1 month	Indef.	Indef.	90	90
SB-1A	3 days	1 month	Indef.	Indef.	40 (used after D-8)	40
SB-3	1 day	1 month	Indef.	Indef.	30	30
SB-4	1 day	1 month	Indef.	Indef.	30	30
Fixing Baths						
F-5	1 week	1 month†	3 months	2 weeks†	120 (W.R.) 20 (SB-3)	120 (W.R.) 120 (SB-3)
F-16	3 days‡	1 week‡	1 week‡	1-2 days	60 (W.R.) 90 (SB-3)	60 (W.R.) 90 (SB-3)
F-52	1 week	1 month	3 months†	3 months†	60 (W.R.) 90 (SB-3)	60 (W.R.) 90 (SB-3)
F-53	—	—	3 months	2 months	—	—
F-54	1 week	1 month	3 months	2 weeks	120 (W.R.) 120 (SB-3)	120 (W.R.) 120 (SB-3)
F-54a	1 week	1 month†	3 months†	2 weeks†	120 (W.R.) 120 (SB-3)	120 (W.R.) 120 SB-3)

† Only keeps 2 weeks at temperatures above 75° F.
‡ Only keeps for 2 days at temperatures above 75° F.
* Life greatly increased by the use of replenisher.
§ Longer life can be obtained if conditions of use are modified, and if some change in quality can be tolerated.

N.R.—Not recommended.
W.R.—Water rinse between development and fixing.

Approximate roll film equivalents in determining useful life of processing solutions:—
2 No. 127 Rolls = one 8 × 10 sheet.
1 No. 135 Roll (36 exp.) = one 8 × 10 sheet.
1 No. 620 or 120 Roll = one 8 × 10 sheet.
1 No. 616 or 116 Roll = 1½ sheets 8 × 10.

TABLES

Tables in Past Almanacs.

The following is a list of tables which have appeared in past issues of the "Almanac," but are not included among those in the present volume. Many are now of historical interest only.

The reference in brackets after each is to the most recent issue of the "Almanac" in which the table has appeared ; in most cases it will be found included for several years prior to the date of this reference.

Chemical

Simplification of Emulsion Calculations (Equivalence of Alkaline Haloid Salts). (1903, p. 1160.)

Solubility of the Silver Haloids.—Valenta. (1907, p. 1109.)

Freezing Mixtures. (1907, p. 1116.)

Developing Equivalence of the Alkalis. (1903, p. 1159.)

Chemical Reactions of the known Developing Agents (Tests of Developers). (1904, p. 1010.)

Pyro Developers recommended for various Plates by Makers. (1890, p. 666.)

Tables of Developers (in grains per oz.) for various Commercial Plates. (1912, p. 761.)

Formulæ of Chemicals. (1924, p. 483).

Solubilities of Chemicals. (1924, p. 489.)

Poisons and Antidotes. (1927, p. 449.)

Light and Exposure

Variation in the Sun's Position at Different Seasons of the Year.—J.A.C. Branfil. (1903, p. 1176.)

Points of the Compass at which the Sun rises for London, Edinburgh and Dublin. (1869, p. 147.)

Sun's Altitude for various Latitudes. (1898, p. 1063.)

Exposure and Lens Aperture. (1910, p. 893.)

Actinograph Exposure Table. (1901, p. 702.)

Comparative Exposures. W. K. Burton. (1887, p. 341.)

Comparative Plate-Speed Numbers (1912, p. 897.)

Colour and Colour Sensitivity

Speeds and Colour Sensitiveness of various Plates to Different Lights. Eder. (1907, p. 1115.)

Wave-lengths of the Principal Fraunhofer Spectrum Lines and the Elements that give them. (1905, p. 1144.)

Reflection of Light from various Surfaces. (1900, p. 1016.)

Optical

Equations relating to Foci, etc.—Branfil —(1907, p. 1120.)

Combining Lenses.—Formulæ. (1910, p. 893.)

Perspective—Factors. (1910, p. 895.)

Correction of Convergent Distortion.—Formulæ. (1901, p. 896.)

Scale of Image. (1910, p. 893.)

Conjugate Foci. (1910, p. 892.)

Royal Photographic Society's Standard Diaphragms. (1903, p. 1178;1905, p. 1149 and 1907, p. 1093.)

Uniform System Numbers for Stops from f1 to f1/00. (1905, p. 1147.)

Continental Stops and their U.S. Equivalents. (1907, p. 1127.)

Correction for Inconsistency of Aperture. (1910, p. 895.)

Angles and Foci of the Telephoto Lens. (1894, p. 949.)

Steinheil's Tables of Camera Extensions, etc., corresponding to a given Magnification of the Telephoto Lens. (1902, p. 732.)

Focussing with Pinhole Apertures. (1896, p. 954.)

Aperture Markings of old Lenses. (1927, p. 457.)

View Angles. (1927, p. 458—459.)

Distances for Cine Projection. (1935, p. 427.)

EXPOSURE

The following table, based on that originally compiled by W. K. Burton, gives a general idea of the exposures for various subjects. They are correct for the best lighting, mid-day summer sunshine, and medium speed plates or films, about 700 H. & D., or 24° B.S. (Log.)

For approximate equivalents in other speed systems, see Table on page 422.

In weather other than bright sunshine the exposures should be multiplied by :—

Bright diffused light	... ...	2
Dull, moderately heavy clouds	...	3
Very dull, dark clouds	... ...	4 to 5

TABLE I.

F/No.	Average Subject with objects in Foreground. Street Scenes. Outdoor Figure Studies.	Landscapes with Light Foreground, Lake, River and Beach Scenes.	Sea Clouds and Sky	Subjects with Extra Heavy Foreground *e.g.*, Dark Trees, Doorways, Groups.	Under Trees, Woods, Avenues, Glades, etc.	Portrait in Average Well-lighted Room.
f/2	1/1000	—	—	1/500	1/60	1/30
f/2.5	1/640	—	—	1/320	1/40	1/20
f/3.5	1/320	1/500	—	1/160	1/20	1/10
f/4.5	1/200	1/320	—	1/100	1/12	1/6
f/6.3	1/100	1/160	—	1/50	1/6	1/3
f/8	1/64	1/100	1/300	1/32	1/4	1/2
f/11	1/32	1/50	1/200	1/16	1/2	1
f/16	1/16	1/25	1/100	1/8	1.0	2.0

Daily Variation in Light for different Latitudes

At other hours of the day and times of the year the above exposures are multiplied by the numbers in Table II, of daylight variation. The figure 1 in Table II indicates times for which Table I suffices by itself. Table II has been worked out for the ALMANAC by R. de B. Adamson, B.Sc., of Christchurch, N.Z.

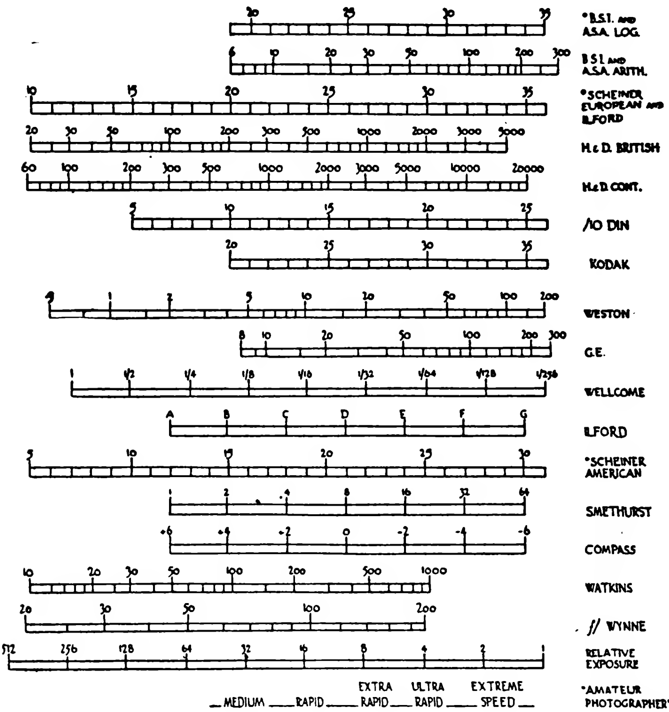
All the factors given are for atmospheric conditions as on a clear day in England. Extreme N. of Scotland, Lat. 60°; S. of Scotland, N. of England, N. of Ireland, Lat. 55°; S. of England, S. of Ireland, Lat. 50°.

TABLE II.

Latitude	North Hemisphere	MORNING									South Hemisphere
		12	11	10	9	8	7	6	5	4	
	June	1	1	1	1½	1½	2	3	4	8	December
	May, July	1	1	1½	1½	1½	2	3	6	10	Jan., Nov.
	April, August	1½	1½	1½	1½	2	3	6	—	—	Feb., Oct.
60°	March, Sept.	1½	1½	2	2	3	6	—	—	—	March, Sept.
	Feb., Oct.	3	3	3	6	—	—	—	—	—	April, August
	Jan., Nov.	4	6	8	—	—	—	—	—	—	May, July
	December	6	8	—	—	—	—	—	—	—	June
	June	1	1	1	1	1½	2	3	4	—	December
	May, July	1	1	1	1½	1½	2	3	6	—	Jan., Nov.
	April, August	1	1½	1½	1½	2	3	6	—	—	Feb., Oct.
55°	March, Sept.	1½	1½	1½	2	3	6	—	—	—	March, Sept.
	Feb., Oct.	2	2	3	4	8	—	—	—	—	April, August
	Jan., Nov.	3	3	4	8	—	—	—	—	—	May; July
	December	4	4	6	—	—	—	—	—	—	June
	June	1	1	1	1	1½	2	3	6	—	December
	May, July	1	1	1	1½	1½	2	3	8	—	Jan., Nov.
	April, August	1	1	1½	1½	2	3	6	—	—	Feb., Oct.
50°	March, Sept.	1½	1½	1½	1½	3	6	—	—	—	March, Sept.
	Feb., Oct.	2	2	2	3	6	—	—	—	—	April, August
	Jan., Nov.	3	3	3	6	—	—	—	—	—	May, July
	December	3	4	6	—	—	—	—	—	—	June
	June	¾	¾	1	1	1½	2	3	—	—	December
	May, July	¾	1	1	1	1½	2	4	—	—	Jan., Nov.
	April, Aug.	1	1	1	1½	1½	3	6	—	—	Feb., Oct.
40°	March, Sept.	1	1	1½	1½	2	4	—	—	—	March, Sept.
	Feb., Oct.	1½	1½	1½	2	4	—	—	—	—	April, August
	Jan., Nov.	1½	2	2	3	6	—	—	—	—	May, July
	December	2	2	3	4	8	—	—	—	—	June
	June	¾	¾	1	1	1½	2	4	—	—	December
	May, July	¾	¾	1	1	1½	2	6	—	—	Jan., Nov.
	April, August	¾	1	1	1½	1½	3	8	—	—	Feb., Oct.
30°	March, Sept.	1	1	1	1½	2	4	—	—	—	March, Sept.
	Feb., Oct.	1	1	1½	1½	3	6	—	—	—	April, August
	Jan., Nov.	1½	1½	1½	2	4	—	—	—	—	May, July
	December	1½	1½	1½	2	4	—	—	—	—	June
	June	¾	¾	1	1	1½	3	8	—	—	December
	May, July	¾	¾	1	1	1½	3	—	—	—	Jan., Nov.
	April, Aug.	¾	¾	1	1	1½	3	—	—	—	Feb., Oct.
15°	March, Sept.	¾	¾	1	1½	1½	3	—	—	—	March, Sept.
	Feb., Oct.	1	1	1	1½	2	4	—	—	—	April, August
	Jan., Nov.	1	1	1½	1½	2	6	—	—	—	May, July
	December	1	1	1½	1½	3	6	—	—	—	June
0°	May, June July, Nov. Dec., Jan.	¾	1	1	1½	2	4	—	—	—	May, June July, Nov. Dec., Jan.
	Other months	¾	¾	1	1	1½	3	—	—	—	Other months
		12	1	2	3	4	5	6	7	8	
		AFTERNOON									

Approximate Equivalence of Speed Systems

It follows from the nature of the characteristic curve of a photographic emulsion and from the different criteria used by the several systems of speed determination that it is quite impossible accurately to convert a speed number on one system to a corresponding number on another system by the use of a simple factor or comparison scale. Such a factor would be valid only for emulsions of the same general



type. Moreover, where speed numbers are used for setting exposure meters, the validity of the resulting exposure depends entirely on the exposure standards adopted by the makers of the meter, which vary so much that it has become customary among certain sensitive materials manufacturers to publish, in addition to the actual speeds according to some accepted speed system, tables showing the speed settings that should be used on various commercial meters, and such tables show wide discrepancies. Also the speed of a material may vary between wide limits depending upon development conditions.

However, the above chart, worked out by Harold Jackson, based on an average interpretation of the various systems, and reprinted from the *B.J.* July 22, 1949, may serve as a useful guide.

Shutter Speeds for Moving Objects

The table given below is so calculated as to give in round figures the shutter speeds necessary to give sharp pictures of various moving objects. Column D is for objects moving directly towards or away from the camera, O is for objects moving obliquely towards or from the camera, say at 45°, and the column A, for the worst case, objects moving directly across the field of view.

The table is based on a formula which was worked out by H. Craebeckx and given in *Photorama* No. 1, 1952 (published by Gevaert Photographic Products S.A. Antwerp). The basic formula assumes an image movement on the film of f/2000, where f is the focal length of the lens, as being unnoticeable and comparable with a circle of confusion of f/1000. The formula is for objects moving directly across the field of view and is in full :—

$$t = \frac{1}{1000} \times \frac{\text{A (in yards)}}{\text{V (in miles per hour)}}$$

where t is the shutter speed necessary, A the distance of the object and V its velocity. For objects moving at 45°, shutter speeds twice as long can be used, and moving directly toward the camera four times as long. For extremely large prints from small negatives a much smaller amount of blur is permissible and so a shorter exposure time must be used.

A simple rule derived from the formula is also given by this author, and can be easily remembered and applied in practice.

This rule states:—*For subjects 5 yards from the camera, the shutter speed equals 1 divided by 200 times the speed in miles per hour.* For subjects at 10 yards the shutter speed need only be half as fast; at 20 yards one quarter as fast and so on.

	D	O	A
Pedestrians (4 miles per hour) ...	1/125	1/250	1/500
Cyclists (10 miles per hour)... ...	1/300	1/600	1/1250
Vehicles (20 miles per hour) ...	1/600	1/1250	1/2500
Football at 50 feet	1/250	1/500	1/1000
Foot races and sports	1/600	1/1250	1/2500
Trotting horses	1/500	1/1000	1/2000
Divers	1/750	1/1500	1/3000
Cycle races, horse galloping ...	1/750	1/1500	1/3500
Yachts (10 knots) at 50 feet ...	1/200	1/400	1/750
Steamers (20 knots) at 50 feet ...	1/300	1/750	1/1500
Trains (30 miles per hour) at 50 feet	1/500	1/1000	1/2000
Trains (60 miles per hour) at 50 feet	1/1000	1/2000	1/4000

In practice it may not be possible to attain these theoretical standards in which case the camera can be moved with the moving object or a certain amount of blur must be tolerated.

WEIGHTS & MEASURES

Metric Weights and Measures

In accordance with past practice, and because we believe that the majority of our readers are still accustomed to work in British measure, we give all formulæ in this Almanac in grains and ounces, the metric quantities necessary to make up a solution of equal strength being given in brackets. Since, however, there is a large and certainly increasing number who work in the far more simple and convenient metric measure, we now include complete conversion tables and factors to enable British measure to be converted to metric. Limited space has necessitated a certain abridgement of both sets of tables, but we hope that the slight extra trouble that may in certain cases be thereby entailed will be outweighed by the increased utility of the tables to a larger number of readers.

British and Metric Equivalents

LINEAR MEASURE.

Inch	=	25.399	mm.	Millimetre	=	0.03937	in.
,,	=	2.5399	cm.	Centimetre	=	0.3937	in.
,,	=	0.0254	M.	Metre	=	39.3701	ins.
Foot	=	0.3048	M.	,,	=	3.2808	ft.
Yard	=	0.9143	M.	,,	=	1.0936	yd.
Mile	=	1609.3	M.	Kilometre	=	1093.6	yds.

SQUARE MEASURE.

Sq. inch	=	6.45	sq. cm.	Sq. cm.	=	0.155	sq. in.
,,	=	645	sq. mm.	Sq. mm.	=	0.00155	sq. in.
Sq. foot	=	0.0929	sq. M.	Sq. M.	=	10.764	sq. ft.
Sq. yard	=	0.836	sq. M.	,,	=	1.196	sq. yd.

WEIGHT.

Grain	=	65	mg.	Milligramme	=	0.015	gr.
,,	=	0.0648	gm.	Gramme	=	15.432	gr.
Ounce	=	28.35	gm.	,,	=	0.0353	oz.
Pound	=	453.57	gm.	Kilogramme	=	35.27	ozs.
				,,	=	2.2046	lbs.

VOLUME.

Minim	=	0.059	c.c.	C.c.	=	16.9	minims
Drachm	=	3.55	c.c.	,,	=	0.28	dr.
Ounce	=	28.4	c.c.	,,	=	0.035	oz.
Pint	=	568.25	c.c.	Litre = 35 ozs. 1 dr. 34 minims			
Gallon (160 ozs.) = 4.546 L.				,, = 16894.1 minims.			

20 standard drops (3 mm. diam.)= 1 c.c. at 15° C.

British Weights and Measures

1. APOTHECARIES WEIGHT.

20 Grains	=	1 Scruple		
3 Scruples	=	1 Drachm	=	60 Grains
8 Drachms	=	1 Ounce	=	480 Grains

It is now customary in formulæ to employ the avoirdupois ounce 437½ grains), but where "drachms" are given the apothecaries drachm of 60 grains is meant.

2. AVOIRDUPOIS WEIGHT.

437½ Grains	=	1 Ounce		
16 Ounces	=	1 Pound	=	7,000 Grains

¼ ounce = 109 grains; ½ ounce = 219 grains; ¾ ounce = 328 grains

3. FLUID MEASURE.

60 Minims	=	1 Drachm				
8 Drachms	=	1 Ounce	=	480 Minims		
20 Ounces	=	1 Pint	=	160 Drachms	=	9,600 Minims
2 Pints	=	1 Quart	=	40 Ounces	=	320 Drachms
4 Quarts	=	1 Gallon	=	160 Ounces	=	1,280 Drachms

1 fluid ounce of water weighs 437½ grains, therefore every minim weighs 0.91 grain.

In the United States the pint is 16 ozs., the quart 32 ozs.

Conversion Tables

Inches and Millimetres

FRACTIONS OF INCHES INTO MILLIMETRES.

MILLIMETRES INTO INCHES AND DECIMALS.

Inches	Millimetres	Inches	Millimetres	Millimetres	Inches	Millimetres	Inches
1	25.4	3/8	9.5	1	0.04	15	0.59
15/16	23.8	11/32	8.7	2	0.08	16	0.63
9/10	22.9	5/16	7.9	3	0.12	17	0.67
7/8	22.2	9/32	7.1	4	0.16	18	0.71
13/16	20.6	1/4	6.4	5	0.20	19	0.75
3/4	19.1	7/32	5.6	6	0.24	20	0.79
11/16	17.5	3/16	4.8	7	0.28	21	0.83
5/8	15.9	1/8	3.2	8	0.31	22	0.87
9/16	14.3	3/32	2.4	9	0.35	23	0.90
1/2	12.7	1/16	1.6	10	0.39	24	0.94
7/16	11.1	1/32	0.8	11	0.43	25	0.98
				12	0.47	25.4	1.0

Inches to Centimetres

Inches	Centi-metres	Inches	Centi-metres	Inches	Centi-metres	Inches	Centi-metres
1	2.54	6	15.24	11	27.94	16	40.64
2	5.08	7	17.78	12	30.48	17	43.18
3	7.62	8	20.32	13	33.02	18	45.72
4	10.16	9	22.86	14	35.56	19	48.26
5	12.70	10	25.40	15	38.10	20	50.80

For conversion from centimetres to inches it is convenient to use the table for millimetres to inches on the previous page, reading centimetres for millimetres and moving the decimal point of the inch equivalent one place to the right.

English Plate Sizes to Metric Measure

Inches	Cm.	Inches.	Cm.
2½ × 3½	8.9 × 6.4	5 × 7	17.8 × 12.7
3¼ × 3¼	8.25 × 8.25	6½ × 8½	21.5 × 16.5
3¼ × 4¼	10.8 × 8.25	8 × 10	25.4 × 20.3
4 × 5	12.7 × 10.1	10 × 12	30.4 × 25.4
4¾ × 6½	16.5 × 12.0	12 × 15	38.1 × 30.4

Continental Sizes to British Equivalents

Cm.	Inches	Cm.	Inches
2.4 × 3.6	1 × 1½	6 × 9	2¼ × 3¼
3 × 4	1⅛ × 1½	9 × 12	3½ × 4¾
4 × 4	1½ × 1½	10 × 15	3.92 × 5.9
4.5 × 6	1¾ × 2⅜	12 × 16	4.72 × 6.30
4.5 × 10.7	1¾ × 4¼	13 × 18	5.12 × 7.08
6 × 6	2⅜ × 2⅜	18 × 24	7.08 × 9.44

Ounces (Avoirdupois) and Fractions into Grains (Fractions of grains are omitted)

¼ oz. = 109 grs.	2¼ ozs. = 984 grs.	4¼ ozs. = 1,859 grs.
½ oz. = 219 grs.	2½ ozs. = 1,094 grs.	4½ ozs. = 1,969 grs.
¾ oz. = 328 grs.	2¾ ozs. = 1,203 grs.	4¾ ozs. = 2,078 grs.
1 oz. = 437 grs.	3 ozs. = 1,312 grs.	5 ozs. = 2,188 grs.
1¼ oz. = 547 grs.	3¼ ozs. = 1,421 grs.	5¼ ozs. = 2,296 grs.
1½ oz. = 656 grs.	3½ ozs. = 1,531 grs.	5½ ozs. = 2,406 grs.
1¾ oz. = 765 grs.	3¾ ozs. = 1,640 grs.	5¾ ozs. = 2,516 grs.
2 ozs. = 875 grs.	4 ozs. = 1,750 grs.	6 ozs. = 2,625 grs.

Ounces (Avoirdupois) to Grammes

Ozs.	Gms.	Ozs.	Gms.	Ozs.	Gms.
¼	7.09	5	141.75	13	368.54
½	14.17	6	170.10	14	396.89
¾	21.26	7	198.45	15	425.24
1	28.35	8	226.80	16	453.59
1½	42.5	9	255.15	17	481.94
2	56.70	10	283.5	18	510.29
3	85.05	11	311.85	19	538.64
4	113.40	12	340.19	20	566.99

Cubic Centimetres to Fluid Ounces and Minims

C.c.	Fl. oz.	Minims.	C.c.	Fl. ozs.	Minims.
1	—	16.9	60	2	54
2	—	33.8	70	2	223
3	—	50.7	80	2	391
4	—	67.6	90	3	80
5	—	84.5	100	3	249
6	—	101	200	7	19
7	—	118	300	10	268
8	—	138	400	14	37
9	—	152	500	17	287
10	—	169	600	21	56
20	—	338	700	24	305
30	1	27	800	28	75
40	1	196	900	31	324
50	1	365	1,000 (1 litre)	35	94

Minims, Drachms and Fluid Ounces to Cubic Centimetres

Mms.	C.c.	Mms.	C.c.	Dchms.	C.c.	Fl. ozs.	C.c.
1	0.059	15	0.888	2	7.10	5	142.1
2	0.118	20	1.18	3	10.66	6	170.5
3	0.178	25	1.48	4	14.21	7	198.9
4	0.237	30	1.77	5	17.76	8	227.4
5	0.296	35	2.07	6	21.31	9	255.8
6	0.355	40	2.37	7	24.87	10	284.2
7	0.414	45	2.66	1 oz.	28.42	20	568.4
8	0.474	50	2.96	2	56.84	30	852.6
9	0.533	55	3.26	3	85.26	40	1137
10	0.592	60 (1 drchm)	3.55	4	113.7	50	1421

Grammes into Grains

(For fractional ounce equivalents of grains see p. 426)

Gms.	Grs.	Gms.	Grs.	Gms.	Grs.	Gms.	Grs.
0.1	1.5	6	92.6	20	308.6	90	1389
0.2	3.1	7	108.0	25	385.8	95	1466
0.3	4.6	8	123.4	30	463.0	100	1543
0.4	6.2	9	138.9	35	540.1	110	1698
0.5	7.7	10	154.3	40	617.3	120	1852
0.6	9.2	11	169.7	45	694.4	130	2006
0.7	10.8	12	185.2	50	771.1	140	2160
0.8	12.3	13	200.6	55	848.8	150	2314
0.9	13.9	14	216.0	60	926.0	160	2469
1	15.4	15	231.5	65	1003	170	2624
2	30.9	16	246.9	70	1080	180	2778
3	46.3	17	262.3	75	1157	190	2932
4	61.7	18	277.8	80	1235	200	3086
5	77.2	19	293.2	85	1312	250	3858

Grains into Grammes

Grs.	Gms.	Grs.	Gms.	Grs.	Gms.
1	0.065	17	1.102	45	2.916
2	0.13	18	1.166	50	3.240
3	0.194	19	1.232	55	3.564
4	0.259	20	1.296	60	3.888
5	0.324	21	1.361	65	4.212
6	0.389	22	1.426	70	4.536
7	0.454	23	1.490	75	4.860
8	0.518	24	1.555	80	5.184
9	0.583	25	1.620	85	5.508
10	0.648	26	1.685	90	5 832
11	0.713	27	1.750	95	6.156
12	0.775	28	1.814	100	6.480
13	0.842	29	1.880	200	12.96
14	0.907	30	1.944	300	19.44
15	0.972	35	2.268	400	25.92
16	1.037	40	2.592	500	32.40

Formulæ Stated in Parts

Formulæ given, as many are, in "parts," may be made up by writing gms. for the solid and c.c.s. for the fluid "parts," and converting them if necessary into the British measures by any of the tables in this section. Thus: Pyro, 10 parts; sodium sulphite, 100 parts; water, 1,000 parts, becomes Pyro, 154 grs.; sodium sulphite, 3 ozs. 230 grs.; water, 35 ozs.

Percentage Solutions

Considerable confusion exists as to the meaning of the term "10 per cent. solution." Properly, such a solution is made up by dissolving 1 gramme of the solid and making up to 10 c.c.s. with water; or in English measure, 1 oz. avoirdupois up to 10 ozs. water. *In American measure*, the two solutions are not exactly equivalent, but the difference is within practical tolerance. A common usage is to dissolve 1 oz. avoirdupois and make up to 9 ozs. 1 drachm with water. Strictly, this is not a 10 per cent. solution, but its convenience lies in the fact that every 10 minims will contain 1 grain of solid, and the chief use of a 10 per cent. solution is to measure out grains of the solid. In any case, the error is unimportant in practically every instance in which such solutions are specified.

Compound Conversion Tables and Factors for Converting Formulæ

The most convenient method of converting the quantities stated in formulæ from British to metric and *vice versa* is by the use of the tables which follow. The conversion factors are given on the next page, following the conversion tables.

CONVERSION TABLES

Grains (and fractional ounces) per 10 Ounces to Grammes per Litre.

Grains per 10 Ozs	Grammes per Litre	Grains per 10 Ounces	Grammes per Litre	Grains per 10 Ounces	Grammes per Litre
1	0.23	50	11.43	900	205.8
2	0.46	60	13.72	1000	228.6
3	0.69	70	16.00		
4	0.91	80	18.29	¼ oz.	25
5	1.14	90	20.6	½	50
6	1.37	100	22.9	¾	75
7	1.60	200	45.7	1	100
8	1.83	300	68.6	1¼	125
9	2.06	400	91.5	1½	150
10	2.29	500	114.3	1¾	175
20	4.57	600	137.2	2	200
30	6.86	700	160.0	2¼	225
40	9.15	800	182.9	2½	250

Grammes per Litre to Grains per 10 Ounces

Grammes per Litre	Grains per 10 Ounces	Grammes per Litre	Grains per 10 Ounces	Grammes per Litre	Grains per 10 Ounces
1	4.4	11	48.1	30	131
2	8.8	12	52.5	40	175
3	13.1	13	56.9	50	219
4	17.5	14	61.2	60	262
5	21.9	15	65.6	70	306
6	26.2	16	70.0	80	350
7	30.6	17	74.4	90	393
8	35.0	18	78.8	100	437
9	39.4	19	83.1	200	875
10	43.8	20	87.5	300	1372

(For fractional ounce equivalents of grains see p. 426)

CONVERSION FACTORS

To convert:—

Grammes per litre into grains per ounce. Multiply by 0.437.

Grains per ounce into grammes per litre. Multiply by 2.28.

C.C.s. per litre into minims per ounce. Multiply by 0.48.

(Or approximately, *divide* by 2).

Minims per ounce into c.c.s. per litre. Multiply by 2.1.

Minims and Drachms per 10 Ounces to Cubic Centimetres per Litre

To convert *minims per* 10 *ounces* to c.c.s. per litre it is sufficiently accurate for all ordinary purposes to *divide minims by* 5 (to be exact, 4.8).

To convert *drachms per* 10 *ounces* to c.c.s. per litre, *multiply by* 12 (to be exact 12.5).

To convert *c.c.s. per litre to minims per* 10 *ozs.* multiply by 5 (4.8).

To convert *c.c.s. per litre to drachms per* 10 *ozs.* divide by 12 (12.5).

Comparison of Thermometer Scales

To convert *Centigrade* to *Fahrenheit* :—

Multiply by $\frac{9}{5}$ and then add 32.

To convert *Fahrenheit to Centigrade* :—

Subtract 32 and then multiply by $\frac{5}{9}$

OPTICAL CALCULATIONS

Finding Focal Length

The focal length of a lens may readily be found as follows: Focus carefully on some very distant object, such as a church spire, and mark the position of any convenient part of the moving lens front on the fixed baseboard of the camera. Then focus sharply on an object of known size, *e.g.* a graduated rule, placed as close to the camera as the available bellows extension will permit. When this has been carefully focussed mark the position of the part of the lens front previously chosen, and then photograph the object. After development measure the length of its image.

If L is the length of the object and l the length of its image on the plate and d the distance between the two marks made on the baseboard, then the focal length of the lens is given by $d \times L \div l$.

This method is theoretically sound and only requires care to give accurate results.

If there is available a camera of extension somewhat greater than twice the focal length which is to be measured a similar method may be used. In this case the procedure is to focus as before on a distant object, marking the position of any convenient part of the moving lens front on the fixed camera baseboard. Then any small object is focussed so that the image is exactly the same size as the object, and the baseboard again marked. The distance between the two marks is the focal length of the lens.

Focal Distances, etc.

Throughout the formulæ, on the next page, the following symbols are used as follows :—

f = the focal length or " focus " of the lens.

u = the distance of the *object* from the lens.

v = the distance of the *image* from the lens, *e.g.*, camera extension in copying, lens-easel distance in enlarging.

D = distance from object to image, neglecting nodal space, which in most lenses, is small compared with D.

R = number of times that the size (linear) of the object divides into that of the image, *i.e.*, No. of times of enlargement.

r = number of times that the size (linear) of the image divides into that of the object, *i.e.*, No. of times of reduction.

The distances u and v are reckoned respectively from the admission and exit nodes of a lens. For practical purposes (except with telephoto lenses) it is near enough to take these as situated at the diaphragm of a compound lens or at the surfaces of a single lens.

All the formulæ are derived from the parent formula.

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

which, in its various forms allows of practically any calculation of image or object size, scale of enlargement or reduction, camera extension, etc., being readily made.

Scale of Reproduction

$R = \dfrac{\text{size of image}}{\text{size of object}}$ (linear) $r = \dfrac{\text{size of object}}{\text{size of image}}$ (linear)

R is No. of times of enlargement. r is No. of times of reduction.

$R = \dfrac{v}{u}$ ... (1) $r = \dfrac{u}{v}$ ... (5)

$R = \dfrac{f}{u - f}$ ... ... (2) $r = \dfrac{u - f}{f} = \dfrac{u}{f} - 1$ ... (6)

$R = \dfrac{v - f}{f}$ ... ... (3) $r = \dfrac{f}{v - f}$ ... ... (7)

$R = \dfrac{D - 2f}{f}$ (approx.) ... (4) $r = \dfrac{f}{D - 2f}$ (approx.) ... (8)

Focal Length

$f = \dfrac{u \times R}{R + 1} = \dfrac{u}{r + 1}$ ... (9) $f = \dfrac{D \times R}{(R + 1)^2} = \dfrac{D \times r}{(r + 1)^2}$ ... (11)

$f = \dfrac{v}{R + 1} = \dfrac{v \times r}{r + 1}$ ... (10) $f = \dfrac{D}{R + 2} = \dfrac{D}{r + 2}$ (approx.) (12)

$f = \dfrac{u \times v}{D}$ ... ... (13)

Distance of Object from Lens

$u = \dfrac{v}{R} = v \times r$ ... ... (14) $u = \dfrac{f \times v}{v - f}$ ... ... (16)

$u = \dfrac{f}{R} + f = (r + 1) \times f$ ... (15) $u = \dfrac{D}{R + 1} = \dfrac{r \times D}{r + 1}$ ... (17)

Distance of Image from Lens

$v = u \times R = \dfrac{u}{r}$ ... ... (18) $v = \dfrac{f \times u}{u - f}$ ... ... (20)

$v = (f \times R) + f = \dfrac{f}{r} + f$ ... (19) $v = \dfrac{R \times D}{R + 1} = \dfrac{D}{r + 1}$ ... (21)

Object-Image Distance

$D = f \times (R + \dfrac{1}{R} + 2) = f \times (r + \dfrac{1}{r} + 2)$ ... (22)

$= \dfrac{f \times (R + 1)^2}{R} = \dfrac{f \times (r + 1)^2}{r}$ (23)

$= f \times (R + 2) = f \times (r + 2)$ (24) (approx.)

$D = \dfrac{v \times (R + 1)}{R} = v \times (r + 1)$ (25) $D = u \times (R + 1) = \dfrac{u \times (r + 1)}{r}$ (26)

Notes on the Formulæ

No. 2.—If the distance u of an object is very great relatively to the focal length f, the latter becomes negligible relatively to u, so that the formula becomes $R = \frac{f}{u}$ according to which the size of the image is directly proportional to f, and inversely proportional to u. While theoretically this is never so, the size of image is proportional (within an error of 1 per cent.) to the distance of the object if the distance of the object is at least 100 times the focal length of the lens. (See B.J., 1921, November 18, p. 686.)

Nos. 3, 7, 16.—When the distance u of the object is very great relatively to the focal length, the distance v of the image from the lens becomes nearly equal to f, and, in consequence of depth of focus, actually equal to f. In these circumstances, corresponding with the photography of distant objects, formulæ 3, 7, 15 cease to apply.

Nos. 1, 2, 3, 5, 6, 7.—Bearing in mind the definitions of R and r these formulæ permit the calculation of the size of image obtained of an object of known size at a given distance with a lens of given focal length and, *vice versa*, the size of an object yielding an image of known size.

Nos. 4, 8, 12, 24.—These approximate formulæ yield results sufficiently near for practical purposes if R or r is greater than about 9 or 10.

No. 20.—If u is very great, compared with f, $u-f$ becomes practically equal to u, and therefore $v=f$.

Examples

The following examples will serve to illustrate the use of those of the above formulæ which are chiefly employed for practical purposes :—

A picture 12 × 6 ft., 20 ft. from the lens is photographed with a 10-in. lens. What is the size of the copy? 12 ft. = 144 ins., 20 ft. = 240 ins. From *Formula* 2, 144 × 10 ÷ (240 − 10) = 144 × 10 ÷ 230 = 6.26 ins. The copy therefore measures 6.26 × 3.13 ins.

Copying to Scale.

In making the copy of a painting on a scale of one-seventh, what focal length is required if the painting is 20 ft. distant ? In *Formula* 9, $u = 20$ ft. $r = 7$, $r + 1 = 8$. The required focal length is therefore 20 ÷ 8 = 2½ ft. = 30 ins.

Enlarging with Camera.

Camera has extension of 14 ins. What is greatest degree of enlargement that can be obtained when using 4 in. lens ? 14 − 4 = 10 in. 10 ÷ 4 = 2½ ; that is, maximum enlargement is 2½ times (*Formula* 3).

Maximum Focal Length.

In a camera for copying-enlarging up to 4 times, an extension of 30 ins. (lens to plate) can be obtained. What is the maximum focal length of lens which can be used ? 4 + 1 = 5. 30 ÷ 5 = 6. (*Formula* 10). Maximum focal length is 6 ins.

In copying originals half scale with camera of 9 ins. extension what is maximum focal length of lens which can be used? 9 × 2 = 18. 18 ÷ 3 = 6 ins. (*Formula* 10). Focal length must not be greater than 6 ins.

Camera Extensions.

What is the required camera extension for copying 8½ × 6½ ins. to 4¼ × 3¼ ins. with a 12 in. lens? In *Formula* 19, reduction figure=2. 12÷2=6. 6 + 12 = 18 ins.

What is the required camera extension when enlarging 4¼ × 3¼ ins. plate to 8½ × 6½ ins. (= 2 times enlargement) with 12 in. lens? In *Formula* 19, $f = 12$; $R = 2$. 12 × 2 = 24. 24 + 12 = 36 ins. = 3 ft.

Enlarging Space.

Enlargements up to 10 diameters are to be made with 8-in. lens. What space is required between negative and easel? In *Formula* 23, $R + 1 = 11$. 11 × 11 = 121. 121 × 8 = 968. 968 ÷ 10 = 96.8 ins. = 8 ft. ¾ ins.

Studio Space.

For making full-length cabinet portraits with 12 in. lens, what distance is required between sitter and focussing screen? If sitter is 70 ins. and figure is 5 ins. on negative $r = 14$. In *Formula* 23, $r + 1 = 15$. 15×15 = 225. ins. 225 × 12 = 2,700. 2,700 ÷ 14 = 192⅞ = 16 ft. ⅞ in.

Magnifiers.

When using a supplementary lens (magnifier) as a means of bringing near objects into focus when employing a camera fitted with a lens adjusted for use at fixed focus, the focal length of the supplementary lens must be equal to the distance of the object. This holds good whatever the focal length of the original lens.

Altering Focal Length.

The rule (very rough, on account of the impossibility of knowing from which part of a lens mount to measure) for finding the focal length of an extra lens, to reduce or increase the focal length of a given lens is as follows :—

Multiply the focal length to be altered by the final focal length desired, and divide the product by the original focal length less the final focal length.

That is : $f_2 = \dfrac{f_1 \times F}{f_1 - F}$

where f_1 is the original focal length, F the final focal length required, and f_2 the focal length of the necessary added lens.

To increase the focal length, use a negative lens.

To reduce the focal length, use a positive lens.

Telephoto Rules.

F=equivalent focal length of complete lens.

f_1 = equivalent focal length of positive.

f_2 = equivalent focal length of negative.

E = camera extension, from negative lens to ground glass.

M= magnification, that is, number of times the image given by the complete lens is larger than that given by positive alone.

Magnification when working at given extension is found by dividing camera extension by focal length of negative lens and adding.

$$M = \frac{E}{f_2} + 1.$$

Camera extension, necessary for given magnification — multiply focal length of negative lens by magnification less 1.

$$E = f_2(M - 1).$$

Focal length of complete lens.—Multiply focal length of positive by magnification.

Diaphragm Numbers

Exposures at Different Apertures.

f/Numbers ...	1.8	2	2.2	2.5	2.7	3	3.16	3.4
Rel. Exposure Required —								
Fractions ...	2/3	3/4	1	1¼	1½	1¾	2	2⅓
Decimal ...	0.83	1	1.33	1.66	2	2.33	2.66	3
Seconds ...	1/1200	1/1000	1/750	1/600	1/500	1/428	1/375	1/325

f/Numbers ...	3.5	4	4.5	5	5.6	6	6.3	8
Rel. Exposure								
Fractions ...	2½	3	4	5	6	7	8	12
Decimal ...	3.33	4	5.3	6.66	8	9.3	10.6	16
Seconds ...	1/300	1/250	1/190	1/150	1/125	1/100	1/95	1/60

The above table gives the relative exposures with lens apertures.

The Fraction line gives a series of f/Nos. each requiring double the exposure of the preceding one. This series is f/2.2, 3.16, 4.5, 6.3. The Decimal line gives a similar series, beginning with *f*/2, viz., f/2, 2.7, 4, 5.6, 8. The last line gives the relative speed of any lens, in comparison with another lens of different aperture.

Equivalent f/Nos. and Uniform System Numbers.

Rel. Exposure Req.	1	2	4	8	16	32	64	128
f/Nos.	4	5.6	8	11.3	16	22.6	32	45.2
U.S. Nos.	1	2	4	8	16	32	64	128

Among Continental opticians at the present time it is usual to adopt a different series of f/Nos. each requiring double the exposure of the preceding one. This series is :—

f/No.	3.16	4.5	6.3	9	12.5	18	25.3	36

Note.—Most lenses are now marked with the f/Numbers, according to one of the above series. The actual diameter of the diaphragm aperture in millimetres is marked on some Continental lenses.

Hyperfocal Distance and Depth of Field

In a camera focussed for infinity, the pencil of rays proceeding from a point at a distance H in front of the lens strikes the plate in a circle, the disc of confusion, the fundamental equation of the lens giving the relation $H = f^2/sc$ (1) where f is the focal length of the lens, s the stop number, and c the diameter of the disc of confusion. If c is the largest disc that is indistinguishable from a point, then H is the hyperfocal distance. It is generally agreed that a disc of 1/100-in. viewed at 10-in. is indistinguishable from a point; therefore if the disc of confusion is restricted to 1/1,000 of the focal length of the taking lens, the resulting picture will seem sharp in definition, to whatever size it may be enlarged, when viewed at the distance which gives correct perspective. Put $c = f/1{,}000$ in (1) and we get

$$H = 1{,}000\,f/s, \quad (2)$$

or, $$H = 1{,}000 \text{ times the effective diameter of the stop} \quad (3)$$

STANDARD OF DEFINITION.

The above standard is recommended for all pictorial work. If a more exacting standard is required, the factor 1,500 or 2,000 may be used instead of 1,000. The Leica standard is 1,500. But the extra stopping down slows the lens, and should not be employed unless necessary. To use 1,500 halves the speed of the lens, and 2,000 reduces it to a quarter.

TELEPHOTO LENSES.

This method gives satisfactory depth of field for a telephoto lens, provided the picture is viewed at the correct distance for true perspective, but in practice the negative will be enlarged to the same size and viewed at the same distance as the product of the normal lens ; in order that it may stand this nearer scrutiny the H.D. must be multiplied by the " power " of the telephoto, the ratio of its focal length to that of the normal lens, which is approximately equal to the diagonal of the negative.

WIDE ANGLE LENSES.

The wide-angle negative should be given extra enlargement above that given to the normal negative, in the ratio of the focal length of the normal lens to that of the wide-angle lens; then both perspective and depth of field will be correct for viewing at the normal distance.

Use of the Hyperfocal Distance

Method I.—If the lens is focussed on the H.D., focus extends from half the H.D. to infinity. In landscape work where everything is wanted in focus, using a 2-in. lens at $f/2$, the effective aperture is 1 in., H.D. 1,000 in., say 84 ft. Focus on 84 ft. and all is sharp from 42 ft. to infinity. Stop down to $f/4$, H.D. is 42 ft. Focus on 42 ft. and everything is sharp from 21 ft. to infinity. Or stop $f/8$ focus on 21 ft. and all is sharp beyond 10$\frac{1}{2}$ ft.

Method II.—Divide the H.D. by 0, 1, 2, 3, 4, 5, etc., in succession and get the series infinity, 84, 42, 28, 21, 16$\frac{4}{5}$, 14, 12, 10$\frac{1}{2}$, 9$\frac{1}{2}$, 8.4, 7$\frac{7}{11}$, 7, 6$\frac{6}{13}$, 6, etc. Focus on any one of these distances, say 14 ft., and at full aperture focus extends one step each side, from 16$\frac{4}{5}$ to 12 ft.

Divide stop diameter by 2, using $f/4$, and focus extends two steps each side, from 10½ to 21 ft. Divide stop diameter by 4, using $f/8$ and focus extends four steps, from 8.4 to 42 ft.

Method III.—The above two methods are particular applications of the general case, in which the lens is focussed for a distance D, and focus extends to a far distance D_1 and a near distance D_2. The circle of confusion is calculated to be a constant fraction (1/1000th for example) of the focal length of the lens in the case of the hyperfocal distance itself, but of the extended focal length when the lens is focussed on a nearer point. Definition is satisfactory when the print is viewed from the distance for true perspective.

The fundamental equation of the lens then gives—

$$D_1 = \frac{HD}{H - D} \qquad D_2 = \frac{HD}{H + D} \qquad (4)$$

H being the hyperfocal distance, and D the distance focussed on.

The extent of focus behind and in front of the plane focussed on, is $\frac{D^2}{H - D}$ and $\frac{D^2}{H + D}$ respectively (5)

If definition is required between the farther and nearer limits D_1 and D_2 the distance D to focus on by eliminating H from (4) is—

$$D = \frac{2D_1D_2}{D_1 + D_2} \qquad (6)$$

Similarly eliminating D from (4), the hyperfocal distance,

$$H = \frac{2D_1D_2}{D_1 - D_2} \qquad (7)$$

Example.—Definition is required between 12 and 20 ft. with a 4-in. lens; what distance must be focussed on, and what is the largest stop that may be used?

By (6), distance D to focus on is 15 ft. By (7) H is 60 ft.

By (2), f being ⅓ ft. s is $\frac{1,000}{3 \times 60} = 5.6$

Method IV.—Subtracting (4) or adding (5), the whole depth of focus is

$$\frac{2HD^2}{H^2 - D^2} \qquad (8)$$

and for large apertures and near distances, so that D is small compared with H, depth of field is—

$$\frac{2D^2}{H} \qquad (9)$$

This is a useful formula for reflex work. For a 6-in. lens at $f/4.5$, the H.D. is 112 ft. and by (9) depth of field at 12 ft. is 31 in. of which rather more than half is behind, and rather less than half is in front of, the plane focussed on. For other distances, depth varies as the square of the distance: distance doubled, depth quadrupled. For different stops, depth varies as stop number: double the stop number, double the depth.

Table of Hyperfocal Distances (in feet)

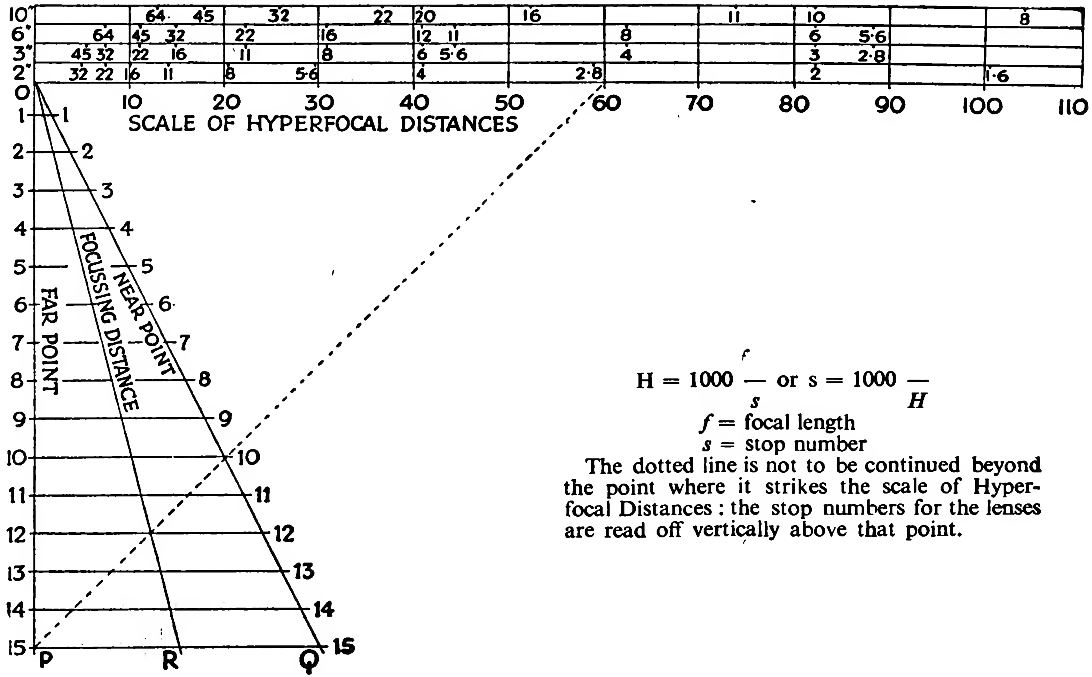
Focal length, inches	Stops											
	f/1	*f*/1.4	*f*/2	*f*/2.8	*f*/3.2	*f*/4	*f*/4.5	*f*/5.6	*f*/8	*f*/11	*f*/16	*f*/22
1	84	60	42	30	27	21	19	15	11	8	6	4
1½	125	89	63	45	40	32	28	23	16	11	8	6
2	168	119	84	60	53	42	37	30	21	15	11	8
2½	209	149	105	75	66	53	47	38	27	19	14	10
3	—	178	126	89	79	63	56	45	32	23	16	12
3½	—	208	147	104	92	74	65	53	37	26	19	13
4	—	—	168	119	105	84	75	60	42	30	21	15
4½	—	—	189	134	118	95	84	68	48	34	24	17
5	—	—	209	149	131	105	93	75	53	38	27	19
5½	—	—	—	163	145	116	103	82	58	41	29	21
6	—	—	—	178	158	126	112	89	63	45	32	23
6½	—	—	—	193	171	137	121	97	69	49	35	25
7	—	—	—	208	184	147	130	104	74	52	37	26

The standard of this table is a maximum disc of confusion in the negative of 1/1,000 of the focal length of the lens, which produces a disc of confusion of 1/100 in. in an enlargement for which the proper viewing distance is 10 in. If a "two-power" telephoto lens is used these hyperfocal distances should be doubled, and similarly for other powers in proportion to the power. This standard of definition is that generally used and found satisfactory; the Leica standard is 1/1,500 focal length; if that standard should be preferred, the above hyperfocal distances must be increased by a half.

Optimum Focussing and Maximum Stop by Chart

The accompanying chart enables the correct focussing distance and the maximum stop allowable to be read off at sight when the near and far limits of the field are known. The dotted tie-line indicates that for a field extending from 10 ft. to 15 ft. from the lens the distance to focus on is 12 ft. and the stop *f*/2.8 may be used on a 2-in. lens. If the lens to be used has a focal length not one of the four exemplified, the chart should be scaled for that focal length by means of the eqn. $H = 1.000\ f/s$ where f is the focal length (in feet) and s the stop number.

The standard of definition assumed here for normal lenses (focal length approximately equal to diagonal of negative) is 1/100 in. in the enlargement when 10 in. is the proper distance for viewing. The Leica standard is 1/150 in. at 10 in.; if this standard is preferred, the chart may be scaled for it by using the coefficient 1.500 instead of 1,000 in the formula for H, or the chart may be used as it stands and the stop numbers read off increased by 50 per cent.



$$H = 1000 \frac{f}{s} \text{ or } s = 1000 \frac{f}{H}$$

f = focal length

s = stop number

The dotted line is not to be continued beyond the point where it strikes the scale of Hyperfocal Distances: the stop numbers for the lenses are read off vertically above that point.

The diagram may be used for any multiple of the indicated feet provided that the *f*/ number is divided by that multiple. Thus the dotted line on the chart indicates that for limits of 100 and 150 ft. the focussing distance is 120 ft., the H.D. 600 ft., and the stop *f*/0.28 may be used on a 2-in. lens. Or for 1½ ft. and 1 ft. the focussing distance is 1.2 ft., H.D. 6 ft., and stop *f*/28. Or for limits of 30 ft. and 20 ft., the focussing distance is 24 ft., H.D. 120 ft. and maximum stop *f*/1.4.

The chart can also be used to give the limits of definition when the distance focussed on and the stop are known. The H.D. for a 3-in. lens at *f*/5.6 is 45 ft.; a line from 45 on the H.D. scale to 10 ft. focussing distance shows definition from 8¼ ft. to 13 ft.

A Depth of Field Table for All Lenses

FOR CONTACT PRINTS ONLY

P. Conklin (B.J., 1937, Oct. 15, p. 663) describes a system of calculating depth of field for group photography, applicable only to contact prints assumed to be viewed at one fixed distance, founded on the measurement of the length of a face on the ground glass. The depth of field for any fixed disc of confusion depends on the size of the image on the ground glass, and is independent of the focal length of the lens. It should, however, be noted that in so far as the system requires that all prints, whatever the focal length of the lens, are to be viewed at a fixed distance, it is not compatible with the maintenance of correct viewing perspective.

The length on the ground glass of a head at the distance focussed on, is measured: say it is ⅝ in. Under the column headed ⅝ in. (size of head) are depths from 16 to 59 in. corresponding to stops from *f*/4.5 to *f*/16. The depth of the group is estimated, and the stop chosen which will produce the depth required, assuming a circle of confusion of 1/125 in. The bottom line indicates camera extension from lens to plane of principal focus which lies about one third way back in total field depth.

Head	7/8"	3/4"	5/8"	1/2"	3/8"	1/4"
Ratio	1:10	1:12	1:14	1:18	1:24	1:36
F 4.5	8"	12"	16"	30"	44"	95"
5.6	10"	16"	21"	35"	56"	123"
8.	14"	22"	29"	45"	83"	176"
11.	20"	32"	40"	64"	106"	XX
16.	28"	46"	59"	105"	168"	XX
	11	13	15	19	25	37

Depth Table for Amateur Cine Cameras

CALCULATED FOR A LENS OF 1 INCH (25 mm.) FOCUS AND A DISC OF CONFUSION OF 0.001 INCH

Distance focussed in feet	f/1.9	f/2.8	f/3.5	f/4
100	30 — inf.	23 — inf.	19 — inf.	17 — inf.
50	23 — inf.	18 — inf.	16 — inf.	14 — inf.
25	16 — 38	13½— inf.	12 — inf.	11 — inf.
15	11 — 22	10 — 30	9 — 40	8 — 55
10	8 — 13	7½— 15	7 — 17	6¾— 19
8	6¾— 10	6⅓— 11	6 — 12	5¾— 13
6	5¼— 7	5 — 7½	4¾— 8	4⅔— 8½
4	3¾— 4½	3½— 4⅔	3⅓— 4¾	3¼— 5
3	2′ 10″—3′ 2″	2′ 9″—3′ 4″	2′ 8″—3′ 5″	2′ 7″—3′ 6″
2	23″—25″	22½″—25½″	22″—26″	21½″—27″

Lenses for Studios

FOCAL LENGTHS OF LENSES FOR STUDIOS OF VARIOUS LENGTHS

The following table shows the focal length of lens suitable for comfortable working in studios of various lengths. In each case it is assumed that 5 ft. of the length will be taken up by camera, operator, sitter and background. The figures in column 1 are the full run of the studio, including this 5 ft. In the case of the short studios the focal lengths are about the longest which can be used: in the longer studios somewhat greater focal lengths might be used, but the lenses advised are about the best for general work.

Length of Studio Feet	C.D.V. full length Inches	C.D.V. half length and Cabinet full length Inches	C.D.V. head, Cabinet half length Inches	Cabinet head and Boudoir full length Inches	Boudoir half length, Panel full length Inches	Boudoir head, Panel half length Inches
12	4*	6½*	8½	9*	12*	14
14	4¾*	7½*	9	10*	13*	16
16	5¾	8½	10	10½	16	18
18	6	8½	10½	10½	16	18
20	6	10	10½	12	18	20
22	7	10½	12	14	22	22
24	8½	12	14	16	24	24
28	8½	13½	16	16	24	24
30	10	13½	16	18	24	24

*Full lengths may be obtained with these focal lengths but with so near a standpoint good perspective cannot be expected.

The dimensions of the sizes quoted above are as follows;—

C.D.V.: 3½ in. × 2$\frac{5}{16}$ in; **Cabinet**: 5⅝ in. × 4$\frac{1}{16}$ in.;
Boudoir: 8 in. × 5¼ in.; **Panel**: 11½ in. × 7 in.

MISCELLANEOUS INFORMATION

Copyright in Photographs

1. Copyright (the right to copy in any form) subsists in photographs because such right is recognised as a species of property by the law of England (and of most other countries).

In Great Britain, the law is embodied in the Copyright Act of 1911 (H.M. Stationery Office, Kingsway, London, 1s) which came into force July 1, 1912.

2. The Copyright Act has been adopted (in some cases with alteration) by the Dominions of Canada and New Zealand, Union of South Africa and Commonwealth of Australia. Copies of the Acts may be obtained from the offices of the respective governments in Ottawa, Dunedin, Pretoria and Canberra. The effect of these Acts is that copyright created in Great Britain extends to those parts of the British Empire.

3. Copyright is created by the mere act of taking the photograph. There is nothing else that should or can be done. It is not necessary to mark photographs "Copyright" in order to create or maintain the copyright in them. There must be copyright in every photograph that is taken, and the copyright must belong to some person.

4. Copyright is the "sole right to produce or reproduce the photograph or any substantial part thereof in any material form whatsoever."

5. Copyright in photographs lasts for 50 years from the making of the original negative.

6. Anything which is not itself copyright may be photographed, and the photograph will be copyright. This applies to people's faces (taken with or without their permission), any scene or landscape, works by the Old Masters of paintings—anything which is *not* a painting, drawing, or other work in which there is copyright. But note :

(*a*) You may take a photograph from an unusual point of view and of course obtain copyright in your picture. But anyone else may afterwards photograph the scene from the same standpoint, and he obtains copyright in *his* picture.

(*b*) A photographic copy of an Old Master is itself copyright if it is made by photographing the original but a photograph of another photograph of the original would (most probably) be an infringement of the copyright in the latter and, therefore, would not be entitled to copyright.

7. Although there is copyright in "architectural works of art" (buildings), the taking of photographs of such buildings is specially permitted by the Act. The same applies to works of sculpture if "permanently situate in a public place."

8. Copyright in a photograph includes copying in another style, *e.g.*, as a drawing in line or wash or in colours, or as an etching, or larger or smaller. Moreover the copy need not be exact to be unlawful. It may be different, but if it is a "colourable imitation," *i.e.*, recognisable as having been made from the photograph, it is unlawful.

9. The copying of part of a photograph, *e.g.*, a face in a group, is also unlawful.

10. Anyone who takes a photograph at his own expense, not to the order of anyone, nor as an employee of somebody, automatically becomes the owner of the copyright.

11. But if the photograph is ordered and is made "for valuable consideration" in pursuance of the order, the copyright automatically becomes the property of the person giving the order; or of the employer, if made by an employee in course of his employment.

12. The copyright continues to be the property of the customer even though he fails to pay. The photographer is not entitled to take the copyright because the customer has not paid. The two things are distinct.

13. Although not the subject of copyright law, the negatives which a photographer makes in executing an order, by common law and long trade custom, are his property, unless in the first instance he contracted to surrender them. But they cannot be used for any purpose except as the customer directs or permits.

14. The copyright in a photograph may be sold outright or piecemeal (*i.e.*, for various limited purposes), but any such transfer is not valid unless in writing.

For example, a photographer may tell a sitter who has come in the usual way that he will charge less if he obtains the copyright. Both parties may agree to this arrangement, but unless a sitter signs a form of words to this effect, he or she is (and continues to be) the owner of the copyright.

15. Any copying or reproduction of a photograph without the permission of the owner of the copyright is an infringement of the latter. It is also an infringement for anyone to sell or show for sale copies that they know to be infringements.

16. When a photograph has been published without permission, the infringer should be asked what compensation he will make—not asked for a particular sum. It is usual to accept twice the fee which would have been charged in the first instance. Anyone concerned in reproducing photographs may be expected to know that there must be copyright in every photograph of recent date. His only defence is that he had permission from someone he thought to be the owner of the copyright.

17. In any action for infringement, the plaintiff is assumed to be the owner of the copyright; it is left to the defendant to show that he is not.

18. Copyright created in Great Britain or in British Dominions also extends to all the countries subscribing to the International Copyright Convention, *viz.*, to the chief countries of the world, with exception of the United States of America and Soviet Russia. According to the Convention, a resident national of any country observes the formalities in his country (none in Great Britain), and obtains in all the other countries the degree of protection granted to their nationals. As a consequence of the Convention, the rights in photographs by people of almost every nationality must be respected in almost every country.

19. As regards the United States, there are various special reciprocal agreements between the U.S. and a number of countries, according to which those who are not American citizens can obtain copyright in the United States by observing the formalities in force there, *viz.*, registration of the photographs in Washington and marking of prints to show that they are copyright. (Particulars from the U.S. Registrar of Copyrights, Washington.) Reciprocally American citizens obtain copyright in Great Britain and in the other countries which have entered into this arrangement.

Reproduction Fees

There is no generally agreed schedule of reproduction fees payable by newspapers and magazines for photographs published by them.

The newspaper and periodical associations and the principal Fleet Street agencies have agreed a schedule, which we reproduce below, but this is binding only between the signatories of the agreement, and while some newspapers pay these rates to all photographers without discrimination others do not, and with these the photographer must make his own arrangements.

	Newspapers	London	Provincial
Stamp heads up to	2½ sq. ins.		18/0
Any picture up to	10 sq. ins.	42/0	25/2
„ „ over 10 up to	30 sq. ins.	50/0	25/2
„ „ „ 30 „ „	50 sq. ins.	75/0	25/2
„ „ „ 50 „ „	80 sq. ins.	105/0	50/5
„ „ „ 80 „ „	150 sq. ins.	210/0	75/7
„ „ „ 150	200 sq. ins.	252/0	75/7
„ „ „ 200	250 sq. ins.	315/0	75/7
„ „ „ 250	300 sq. ins.	420/0	75/7
„ „ „ 300	350 sq. ins.	504/0	75/7

		Periodicals Class B.	Class C.	Class D.
Not exceeding	3 sq. ins.	... 24/2	24/2	24/2
Between	3-12 sq. ins.	... 32/2	32/2	24/2
	12-30 sq. ins.	... 40/3	32/2	24/2
	30-60 sq. ins.	... 69/0	57/6	48/3
	60-90 sq. ins.	... 138/0	115/0	96/7
Over	90 sq. ins.	... 230/0	207/0	193/2

Class B includes: Queen, Sphere, Field and similar weeklies Vogue, Britannia and Eve, Times Weekly, Radio Times, Listener, Everybody's, etc.

Class C includes: Publications by Amalgamated Press, Cassells, George Newnes, Arthur Pearson, Hutchinson & Co., Odhams Press, Monthly Magazines such as Homes and Gardens, Good Housekeeping.

Class D: All publications not included in the Press Fees Agreement or the above classes.

Special rates apply to pictures sent by wire or radio, and for pictures brought by or taken from a specially chartered aircraft.

NOTE.—Where special terms are expected for an exclusive photograph, this should be stated on back of print. Special terms should, wherever possible, be negotiated in advance.

Factories Acts

A new act was passed in 1948 to amend the Factories Act 1937, which itself was to consolidate (with certain amendments) the Factory and Workshop Act, 1901 to 1929. Copies of the 1937 and 1948 Acts may be obtained from H.M. Stationery Office, price 2s. 6d. and 4d. respectively, excluding postage.

Premises in Great Britain where persons are *employed* in photographic work come within the regulations of the Acts. They do *not* apply to premises where assistants are *not* employed (one-man businesses), but cover any workplace in which two or more persons, with the agreement of the owner or occupier, carry on work which would constitute the workplace a factory if the owner or occupier were their employer. In such a case (the premises not being part of a tenement factory) the owner or occupier comes under the Acts as though he were the occupier of the "factory" and the employer of the work-people.

A prescribed Register must be kept; in this must be entered particulars of "young persons" employed, and dates of periodical painting, or limewashing, and of accidents, which must also be reported to the Inspector for the district if the person concerned is incapacitated for more than three days next after the occurrence of the accident.

H.M. Factory Inspectors are to a large extent technical experts, and it is always well to welcome their inspection before making any changes in existing workshops. A person intending to occupy premises as a factory must, not less than one month before occupation, send written notice to the Inspector for the district, giving name, address, nature of work, and details of mechanical power to be used, if any.

The following are the principal requirements which apply to photographic premises.

Notices.—There shall be displayed, at employees' main factory entrances, an abstract of the Factories Acts, names and addresses of the Inspector for the district, the Superintending Inspector for the division, and of the Appointed Factory Doctor. Also details of the day and time of the weekly half-holiday, and a specified public clock. A General Register must be kept, with details of "young persons" employed—both boys and girls. The Register must be kept available and produced when demanded by the Inspector. Periodical returns, at intervals of not less than one year, must be sent to the chief Inspector, giving details of the hours of employment of women and young persons, with age, sex and occupation. A "woman" is defined as a woman who has attained the age of 18, while a "young person" is one over 14 but under 18, of either sex.

Health, Hygiene, and Safety.—Young persons must be certified fit for employment by the appointed factory doctor, and any condition on which a certificate is issued before the young person attains the age of 16 will continue to have effect after that age is reached. A certificate issued after October 1st, 1948, will be in force for twelve months, or any prescribed shorter period, but may be varied or revoked by the appointed factory doctor upon examination. From October 1st, 1950, there must be provided and maintained suitable facilities for sitting for any employed persons when there are reasonable opportunities for sitting without detriment to work. When work can be done sitting, seats must be provided, the size, design and construction of which are suitable for the person and the work. The seat must be adequately supported, and a footrest must be provided if the feet are not properly supported without such rest. The Act requires 400 cu. ft. of space per employee in any room, and reasonable ventilation and temperature and precautions against fire. Moving parts of machinery must be fenced, and all electrical machines must be efficiently earthed. A first-aid box must be kept in the charge of a named person. Precautions against fire apply particularly to the handling of celluloid films, and smoking, use of naked lights, etc., is prohibited. The possibility of fire is greatest in the handling of roll-films.

Special Regulations.—In places where celluloid in the form of roll-film or cut film is used the Celluloid Regulations are operative (see below). These include fire-resisting storage, prohibition of naked lights, etc., unless adequately protected, no smoking, easy exits, and outward-opening, swinging, or sliding doors. Emergency exits should be so marked in large red letters. The Cinematograph Film Regulations do not apply to still photographic work nor to the manipulation of non-flame film.

Hours of Employment.—There is no restriction as to the employment of men, including boys over 18. Permissible hours of employment for women and young persons for full days are as follows: A young person under 16 must not work more than 44 hours in a week, which must be between 7 a.m. and 6 p.m. Workers over 16 may work 7 hours a day or 48 hours a week, the limiting hours being 7 a.m. and 8 p.m. The total hours for a day, including meal and rest times, must not exceed 11. Periods of work must not be over 5 hours, of which 10 minutes must be rest time, as otherwise the periods must not exceed 4½ hours. A half-hour rest must be given between periods. The periods must be the same for all workers in this class. The times used must be stated on a prescribed form affixed in the factory. No Sunday work is permitted.

Overtime.—Women and young persons who are 16 may work overtime, but the total of hours so worked must not exceed 100 in any one year, or 6 in a week, and must not take place in more than 25 weeks in a year. The total day must not exceed 12 hours in the factory (or 10 hours of work) which must be between 7 a.m. and 8 p.m. Women over 18 years of age may work until 9 p.m. Where a five-day week operates, women and young persons aged 16 or over may work overtime by extending the period of work to 10½ hours, but no overtime is allowed if any work is done on the sixth day, since the working day may be extended to 10 hours in a five-day week.

Storage of Celluloid

In Great Britain the storage of celluloid in the form of sensitive film or celluloid negatives is subject to the regulations set forth in "Statutory Rules and Orders, 1921, No. 1825" (H.M. Stationery Office, London, Edinburgh, Manchester, Cardiff and Belfast, price 1d.) under Section 79 of the Factory and Workshop Act.

A memorandum prepared specially for the information of professional photographers on the storage of celluloid on premises to which the Factory and Workshops Acts apply is obtainable from the Home Office, Whitehall, London, S.W.1.

As regards sensitive films kept on premises in quantity which as a rule does not exceed 14 lbs. storage in a drawer or cupboard in a private office or other room in which no handling of celluloid is done is officially regarded as complying with the requirement for " safe storage."

The regulations in respect to developed negatives will depend to some extent on the amount of such negatives. Where the latter are of considerable weight, they require to be kept in a fire-resisting store, such as a cabinet or cupboard constructed of fire-proof material, *e.g.*, sheet metal, asbestos sheeting, or wood effectively treated to resist flame. This store requires to be of sound construction and is to be kept locked. The door or lid needs to be so arranged that there is no naked light or open fire near at hand. The store should not be situated in a work-room where celluloid is handled nor on a stair, nor near a door, nor in a passage through which persons might have to pass to escape in the event of a fire. The nature of the contents should be clearly marked on the outside of the store, and a cautionary notice put up prohibiting the use of naked lights. An adequate supply of buckets of water should be kept always available close outside the store, water being the best extinguisher of celluloid.

The foregoing recommendations are for general guidance and are subject to modification, according to the quantity of celluloid, or on account of the design of the building or nature of the processes, at the discretion of the District Inspector of Factories.

Premises may be exempted from the above regulations on the authority of the Chief Inspector of Factories, Home Office, Whitehall, London, S.W.1.

The Shop Acts (Great Britain)

Under the Shop Acts of 1911 and 1912, the parts of a photographer's premises in which goods are sold to the public is a " shop." As such, it must be closed one half-day in each week from 1 p.m. unless exempted on certain grounds.

It has, however, been held that a photographer may admit sitters to his establishment on the weekly half-holiday by previous appointment, but must not keep the " shop " open for chance passers-by.

Assistants in a " shop," that is to say receptionists and others who take orders from customers, or despatch goods, are entitled under the Act each week to one half-day holiday beginning not later than 1.30. The half-holiday may be on the half-day closing day or on another day of the week. The employer is required to put up a notice in his shop stating the days when his assistants are to have their half-holiday.

In holiday resorts in which an Order allowing shops to keep open during the holiday season on the weekly half-holiday is in force, an employer who satisfies the local authority that he gives his assistants a holiday on full pay of not less than two weeks during the year and pcsts a notice to that effect in his shop, need not give his assistants a half-holiday during the time the Order is in operation.

The Shop Acts are administered by local authorities ; applications for information on particular points should be made in the photographer's district.

Sunday Closing of Shops

The Shops (Sunday Trading Restriction) Act, 1936, in so far as it affects photographers and retail photographic traders, requires the closing of shops on Sundays and prohibits retail trading (other than the sale of passport photographs) in any place whatsoever, *e.g.*, street trading.

(Exception is made in the case of museums, parks, etc., under control of public authorities, etc., and passenger vessels).

The Act does not apply to wholesale trading, nor to Scotland.

The term " trading " includes the booking of orders for taking photographs, but the actual taking of a photograph, provided the order has been booked outside prohibited hours, does not come within the scope of the Act, so that the actual Sunday activities of professional portrait and commercial photographers, press photographers, etc., are not in any way restricted by the Act.

Special provision is made to enable persons of the Jewish religion, and certain other religious bodies, to carry on trade up to 2 p.m. on Sunday provided that they close for the whole of Saturday and comply with certain other conditions.

Provision is also made to meet the special needs of holiday resorts, whereby a local authority may exempt the sale of photographic requisites for 18 Sundays during the year provided the order has the approval of two-thirds of the shopkeepers affected.

Registration of Business Names (Great Britain)

Under the Registration of Business Names Act, 1916, it is required that persons who carry on a business in Great Britain under a name which is not their true name or the name by which they have always been known shall register the business with the Register of Business Names.

It is required that a person or partnership shall register if the " business name " includes any addition to the name of the person or names of partners. Thus Joseph Jones, if he trades as " Jones & Co.," must register.

Also every individual or firm who, or a member of which, has either before or after the passing of the Act changed his name must register. This does not apply to women who change their name by marriage.

The cost of registration is 5s. Offices of the Registrars are : England and Wales, Bush House, South-West Wing, Strand, W.C.2; Scotland, Exchequer Chambers, Parliament Square, Edinburgh; Northern Ireland, 15, Donegall Square West, Belfast ; Irish Free State, Coleraine House, Dublin.

Registered firms must state in all catalogues, circulars, show cards and business letters, on which the name appears, the Christian name or initial and surname of the proprietor, and in businesses belonging to more than one person, of all partners.

If the individual " proprietor " or partners are not British, the nationality must also be stated on business stationery ; and if there has been a change of nationality, the original nationality.

Fines not exceeding £5 may be inflicted for failure to register or non-observance of these provisions.

Photographers who come within the Act are not required to publish their true names on photographs, postcards, etc.

Passport Photographs.

Photographs for British Passports must not be larger than $2\frac{1}{2} \times 2$ inches, or smaller than $2 \times 1\frac{1}{2}$ inches. Two copies are required, unmounted, and must be printed on normal thin paper which must not be glazed on the reverse side. The portrait must be taken full face, without hat. Retouching is permitted so long as permanent identification marks are left intact. A good average size for the head is $1\frac{1}{4}$ in. from top of head to base of chin.

Purchase Tax.

The provisions of the Purchase Tax regulations are so complex that any attempt to summarise them would merely be misleading. The Editor of the British Journal of Photography will however be pleased to reply to queries so long as these are each accompanied by a stamped addressed envelope and addressed: The Editor, British Journal of Photography, 24, Wellington Street, London, W.C.2. Queries on any other photographic subject will likewise be answered by that Journal.

EXPORT CREDITS GUARANTEES

Firms engaged in export trade can obtain valuable help and backing from the Export Credits Guarantee Department.

This Department can insure exporters against the main risks of financial loss to the extent of 85 per cent. to 90 per cent. of the value of overseas transactions. E.C.G.D. issues a number of standard guarantee Policies to cover most aspects of export trade, and, if necessary, will write special policies to meet special circumstances and conditions. These policies are divided into three categories:

(i) Short Term, for consumer goods sold on short credit terms up to 6 months.

(ii) Medium Term, for credits of more than 6 months, chiefly for capital goods.

(iii) Dollar Drive for the special risks in the production of goods for and selling in the North American and the Latin American Dollar Account markets.

Short Term Policies

The main risks of loss covered by E.C.G.D. Short Term Policies are:

(*a*) A buyer's insolvency or prolonged default.

(*b*) Exchange restrictions or shortages preventing the transfer of payment to the United Kingdom.

(*c*) War in the buyer's country or between his country and the United Kingdom, and civil war and disturbances in the buyer's country.

(*d*) The imposition of import and export licencing restrictions.

A number of other risks outside the United Kingdom, and beyond the control of the exporter or his buyer, are also covered. For losses due to insolvency or default there is 85 per cent. cover, and payment is made on the insolvency of the buyer or after twelve months default.

For all other risks, there is 90 per cent. cover, with payment of claims six months after the occurrence of the event causing the loss.

Premiums for E.C.G.D. Policies are quoted at a rate per £100 and vary according to the countries involved, the type of goods and the terms of payment. Except for special policies, premiums seldom rise above £1 per £100 value of exports insured.

Policies cover an exporter's whole turnover, and can give cover for direct exports, re-exports or merchanting business from the date of contract to the final receipt of payment, or can give similar cover from the date of shipment only. Individual contracts do not have to be registered or declared; only monthly totals of business for each country. Each Policy contains an agreed figure up to which the exporter may trade with individual buyers without prior reference to E.C.G.D., but above that figure, " credit limits " have to be agreed. This is in itself a valuable part of E.C.G.D. cover for it enables bad debts to be avoided at the outset and gives a useful guide as to a buyer's standing.

E.C.G.D. Policies are valid for one year, and may be renewed each year thereafter.

Medium Term Policies

These policies, which are designed chiefly to cover exports of capital goods, are given for individual contracts, and give cover for the same range of risks as Short Term Policies.

Dollar Drive Policies

This series of policies has been introduced to help exporters who wish to develop or increase the sale of their products in Canada and the United States of America. The series comprises policies to cover the risks inherent in the various stages and techniques of marketing in North America: market surveys and products tests, advertising and sales promotion campaigns, and the holding of stocks in the market to facilitate delivery and servicing. Joint Venture Guarantees are available for those who intend to make a long-term effort in the North American market, covering periods of up to six years.

In addition to the aforementioned risks these policies can cover the risks encountered in the production of goods for sale in North America.

Special adaptation of the Department's normal Short Term policies, covering Canada and/or U.S.A. only and frequently giving more generous credit limits are available for exporters who have already found a suitable channel for distribution of their goods. In general terms these policies can also be made available for exporters to the Latin American Dollar Account markets but the forms of cover to meet individual cases will depend upon the local conditions existing in those markets.

Further information can be obtained from your nearest E.C.G.D. local office.

E.C.G.D. has eleven District and Branch Offices in London (Monarch 7313 and Grosvenor 6191), Birmingham (Midland 1527), Bradford (Bradford 25147), Glasgow (Central 3056), Manchester (Central 8861), Belfast (Belfast 29428), Sheffield (Sheffield 25898), Bristol (Bristol 22011), Leeds (Leeds 30082) and Liverpool (Central 5756).

The Staff of these offices will be glad to give an exporter full details of E.C.G.D's policies, and advise them how best they may be applied to a particular export business. Interviews can be arranged at the local offices or at the exporters' own office, as he desires.

Text Books

In the following abridged list the aim has been to include the most important books available to-day together with a selection, necessarily small, of older books of real value now out of print. Some of these can still be obtained second hand, most can be consulted at or through libraries. Limitations of space compel us to refer readers to earlier editions of the Almanac for a fuller list of out-of-print books.

Every care has been taken to bring prices up-to-date, but no responsibility can be taken for their accuracy.

Historical and Encyclopaedic

Photographic Researches of Hurter and Driffield. W. B. Ferguson. 25s.

History of Photography. Dr. Erich Stenger, *trs. Ed.* Epstean. $5.

History of Photography. J. M. Eder, *trs. Ed.* Epstean. $10.

Photography: Principles and Applications. A. Watkins. 12s. 6d.

Evolution of Photography. John Werge.

Photography and the American Scene. Robert Taft. 30s.

The Camera as Historian. H. D. Gower, L. Stanley Jast and W. W. Topley. 6s.

Modern Applied Photography. G. A. Jones. 9s. 6d.

The History of Three-Colour Photography. E. J. Wall. $15.

History of Color Photography. J. S. Friedman. 90s.

Progress in Photography. D. A. Spencer. 42s.

A Half Century of Color. L. W. Sipley. 60s.

100 *Years of Photography.* L. Moholy. 6d.

The Modern Encyclopedia of Photography. 2 vols. 18s. ea.

Dictionary of Photography. Ed. A. L. M. Sowerby. 21s.

Immortal Portraits. Alec Strasser. 12s. 6d.

Julia Margaret Cameron. Helmut Gernsheim. 25s.

Friese-Green. Ray Allister. 12s. 6d.

Photo Words in Four Languages. 3s. 6d.

Advanced Text-books and General and Elementary Guides

The Theory of the Photographic Process. C. E. K. Mees. 112s. 6d.

Photography, Theory and Practice. L. P. Clerc. 35s.

Photography: Its Materials and Processes. C. B. Neblette. 47s. 6d.

Properties of Photographic Materials. L. P. Clerc (*trs.* C. J. Duncan). 35s.

Handbook of Photography. Keith Henney & Beverly Dudley. 72s. 6d.

Principles of Photographic Reproduction. C. W. Miller. 45s.

The Kodak Data Book of Applied Photography. (4 Vols.) 52s. 6d.

Photo-Lab-Index. (2 Vols.) 168s.

Photographic Emulsions. E. J. Wall. 24s.

Photographic Emulsion Technique. T. Thorne Baker. 38s.

Photography. C. E. K. Mees. 7s. 6d.

Photography To-day. D. A. Spencer. 7s. 6d.

The Perception of the Visual World. J. J. Gibson. 35s.

Fundamentals of Photography. C. E. K. Mees. 5s.

Graphic Graflex Photography. Willard D. Morgan & Henry M. Lester. 42s.

Ilford Manual of Photography. 10s.

The Complete Amateur Photographer. Dick Boer. *Ed.* A. L. M. Sowerby. 21s.

How to Take Photographs. B. Collier. 18s.

Twin Lens Camera Companion. H. S. Newcombe. 15s.

Perfect Negatives. B. T. J. Glover and G. L. Wakefield. 7s. 6d.

Photographic Facts and Formulas. E. J. Wall and F. L. Jordan. 35s.

The All in One Camera Book. W. Emanuel and F. L. Dash. 9s. 6d.

Exposure. W. F. Berg. 21s.

Exposure Meters and Practical Exposure Control. J. F. Dunn. 35s.

Photographic Exposure. P. K. Turner. 6s.

The Photographer's Guide to Better Pictures. W. F. F. Shearcroft. 6s.

Brighter Photography for beginners. D. Charles. 6s.

The Young Cameraman. G. Catling. 8s. 6d.

Amateurs Just Like You. 15s. 6d.

Make Your Pictures Sing. Paul Louis Hexter. 25s.

Safety Measures in Chemical Laboratories. (H.M.S.O.) 6d.

Photographic Chemicals and their uses. W. F. F. Shearcroft. 6s.

Photographic Chemicals and Chemistry. J. Southworth and T. L. J. Bentley. 8s. 6d.

Photographic Chemicals and Solutions. Crabtree and Matthews. 24s.

Basic Photo Series. Ansel Adams. 25s. each.

1. *Camera and Lens.*
2. *The Negative: Exposure and Development.*
3. *The Print: Contact Printing and Enlarging.*
4. *Natural-Light Photography.*

Developing: The Negative Technique. C. I. Jacobson. 15s. 6d.

Intensification and Reduction. E. J. Wall. 5s.

The Mountain Scene. F. S. Smythe. 12s. 6d.

Lakeland Journey. W. A. Poucher. 21s.

Mountain Photography. C. Douglas Milner. 19s. 6d.

Peak Panorama. W. A. Poucher. 21s.

New Photo Vision. H. Gernsheim. 10s. 6d.

Photography and the Art of Seeing. M. Natkin. 21s.

The Man Behind the Camera. Ed. H. Gernsheim. 25s.

Creative Camera Art. Max Thorek. 18s. 6d.

Image Management. Nicholas Haz. $3.50.

Modern Control in Photography. Ed. John Erith. 27s. 6d.

Pearlman on Print Quality. Alec Pearlman. 12s. 6d.

Pictorial Composition in Photography. Arthur Hammond. 30s.

Composition and Pictures. E. P. Custis. 50s.

Erith on Pictorial Photography. John Erith. 30s.

Composition for Photographers. R. N. Haile. 17s. 6d.

Composition for Photographers. C. Simpson. 10s. 6d.

Pictorial Composition. Bertram Cox. 8s. 6d.

Pictorial Composition in Monochrome and Colour. E. G. Barber. 7s. 6d.

Photographic Skies. D. Charles. 5s.

What's Wrong with this Picture ? Charles Abel. 42s.

Photographic Hints and Gadgets. Fraprie and Jordan. 17s. 6d.

Modern Fluorescent Lighting. A. D. S. Atkinson. 15s.

Light and Colour in the Open Air. M. Minneart. 15s.

Copyright. T. A. B. White. 4s.

Photographers and the Law. D. Charles. 7s. 6d.

Small Handbooks

Light on Exposure Problems. P. C. Smethurst. 2s. 6d.

Teach Yourself Photography. S. W. Bowler. 6s.

Photography for Boys and Girls. S. W. Bowler. 6s.

Straightforward Print Making. H. A. Mannheim. 5s.

Boy's Book of Photography. J. A. Cash. 9s. 6d.

Straightforward Developing. H. A. Mannheim. 5s.

So You're Taking Up Photography! H. G. Russell. 2s. 6d.

Portraiture. Parts I and II. F. C. Tilney. 1s. each.

Photographer's Data Book. Ed. E. S. Bomback. 8s. 6d.

Fotojob Books:

Wedding Photography. G. Catling. 7s. 6d.
Group Photography. G. Catling. 7s. 6d.
Photographing Machinery. B. Alfieri. 7s. 6d.

The Focal Photo-Guides. 2s. each:—

All About—
Focusing. F. W. Frerk.
Sunshine. E. Smith.
Filters. C. I. Jacobson.
Portraits. H. van Wadenoyen.
Exposure. C. I. Jacobson.
The Right Moment. A. Strasser.
Landscapes. H. van Wadenoyen.
Formulae. C. I. Jacobson.
Daylight Indoors. H. van Wadenoyen.
Improving Negatives. F. W. Frerk.
Winter Photography. E. Smith.
Tracing Troubles. A. Merryweather.
One Lamp Only. H. van Wadenoyen.
The Second Lamp. H. van Wadenoyen.
Composition. A. Kraszna-Krausz.
Improving Prints. F. W. Frerk.
Against the Sun Effects. H. van Wadenoyen.
Photos in the Garden. R. M. Fanstone.
Copying. H. W. Greenwood.
Enlargements. C. I. Jacobson.
Processing. C. I. Jacobson.
Architecture. R. M. Fanstone.
Selling Photographs. B. Alfieri.
Sports and Games. L. Vining.
Pictures in Town. H. van Wadenoyen.
Children Outdoors. H. van Wadenoyen.
Cameras. B. Alfieri.
Cats and Kittens. P. Johnson.
Dogs and Puppies. P. Johnson.
Children Indoors. H. van Wadenoyen.
Mother and Child Pictures. T. P. H. Miller.
Lighting for Glamour. W. Nurnberg.
Flash Photography. F. W. Frerk.
Night Photography. F. Purves.
Making Contact Prints. B. Mautner.
Using a Miniature Camera. P. Harris.
Taking Weddings. G. Catling.
Taking Baby. W. Suschitzky.
Print Finishing. R. M. Fanstone.
Building Your Own Enlarger. G. Catling.
Making Camera Gadgets. L. C. Mason.
Processing 35-mm. Film. P. Harris.
Taking Parties and Groups. G. Catling.
Taking Pictures in the Hills. D. C. Milner.
Making Lighting Gadgets. L. C. Mason.
Travelling with Your Camera. E. Richardson.
Photographing Shows. A. Wilson.
Great Occasions. G. Catling.
Darkroom Gadgets. L. C. Mason.
Making a Flashgun. M. M. Warner.
Negative Retouching. J. E. Redon.
Colouring. R. M. Fanstone.
See also **Cinematography** *and* **Colour.**

Focal Photo Pamphlets:

Home-made Papers, Films, Plates C. I. Jacobson. 2s. 6d.
Switching over to 35-mm. W. D. Emanuel. 2s. 6d.
Depth of Focus. Arthur Cox. 3s. 6d.
Making an Enlarger. H. van Wadenoyen. 3s. 6d.

Focal Technical Data Charts:

Exposure Chart. W. D. Emanuel. 3s. 6d.
Focusing Chart. Arthur Cox. 3s. 6d.
Filter Chart. W. D. Emanuel. 3s. 6d.
Developing Chart. W. D. Emanuel. 2s. 6d.
Lighting Chart. W. D. Emanuel. 3s.
Flash Chart. W. D. Emanuel. 3s. 6d.
Stop and Speed Chart. Steffens. 3s. 6d.
Enlarging Chart. 7s. 6d.
Flash Disc. W. D. Emanuel. 5s.
Exposure Disc. W. D. Emanuel. 5s.

The Fountain Press Photofacts Series. 2s. 6d. each:—

The Camera. G. L. Wakefield.
Focusing. E. S. Bomback.
Exposing. E. S. Bomback.
Colour Filters and Their Uses. G. L. Wakefield.
Composing. E. G. Barber.
Outdoor Portraiture. F. and M. Partington.
Landscape Photography. E. G. Barber.
Seaside Photography. E. G. Barber.
The Amateur's Darkroom. T. Dalby.
Developing the Film. R. Bomback.
Contact Printing. R. Bomback.
Enlarging. G. L. Wakefield.
Developing the Print. E. S. Bomback.
Holiday Photography. F. and M. Partington.
Outdoor Lighting. H. G. Russell.
Lantern Slides. J. S. Waring.
Artificial Lighting. H. R. Alder.
Flash Photography. R. Heath.
Portraits Indoors. F. Harris.
Action Photography. D. Dobbin.
Exposure Meters. G. L. Wakefield.
Lenses and Shutters. G. L. Wakefield.
Negative Faults. F. Harris.
Print Faults. F. Harris.

Photographing Architecture. Margaret F. Harker.
Photography at Night. E. S. Bomback.
Still-Life Photography. D. G. Sheldon.
Animal Photography. H. C. Stacy.
Electrical Facts for Photographers. R. H. Alder.
Chemicals in Photography. A. Page.
Toning the Print. A. Page.
The Exhibition Print. A. D. Bensusan.

Photofacts Vols. 1, 2, 3 *and* 4. *Ed.* G. L. Wakefield. 25s. each.

Photofacts Complete Pocket Calculator. E. S. Bomback. 8s. 6d.

Optics

Photographic Optics. Arthur Cox. 17s. 6d.

Practical Optics. B. K. Johnson. 15s.

Lenses in Photography. P. Kingslake. $2.95.

Camera Lenses. A. Lockett. (rev. H. W. Lee). 10s. 6d.

Telephotography. C. F. Lan-Davis and H. A. Carter. 7s. 6d.

Prism and Lens Making. F. Twyman. 58s.

Lens Work for Amateurs. Henry Orford. *Revised* A. W. Lockett. 10s. 6d.

Introduction to Theoretical and Experimental Optics. J. Valasek. 52s.

Introduction to Applied Optics. L. C. Martin. (2 vols.) 21s. each.

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Optical Instruments. Proceedings of the London Conference 1950. 42s.

Special Applications

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Visual Aid Yearbook, 1951. *Publ.* "Daily Mail." 5s.
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The Cine-Camera. R. H. Bomback.
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Colour

(*See also under "Historical"*)

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An Introduction to Color. R. M. Evans. 48s.

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Color in Business, Science and Industry. D. B. Judd. 52s.

The Eighth Art: a Life of Colour Photography. V. Keppler. 42s.

Kodachrome and Ektachrome from All Angles. F. Bond. 63s.

Principles of Color Photography. Evans, Brewer and Hanson.

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Color Photography for the Amateur. K. Henney. 42s. 6d.

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Colour Transparencies. C. L. Thomson. 17s. 6d. (1950 supplement published separately. 1s.)

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The Technique of Colour Photography. F. R. Newens. 8s. 6d.

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Colour Outdoors. G. Wells.
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Taking Children in Colour. G. Wells.
Flash and Colour. G. Wells.
Your Holidays in Colour. G. Wells.

The Fountain Press Colourfacts Series. 7s. 6d. each.
Colour Before the Camera. K. Helmer-Peterson.
Colour Separation Negatives. W. J. Pilkington.

Directory of Photographic Apparatus Repairers

A Photographic Apparatus Repairers' Group has been formed by the Photographic Dealers' Association, the objects of which are broadly to maintain a high standard of service to the customer and to provide the machinery for co-operation between repairers for their mutual benefit and convenience. In order to become members of the Group, repairers have to satisfy the Committee as to their suitability; they must undertake to insure customers' property while in their possession and be prepared to allow persons appointed by the Committee to visit their workshops. Any complaints about inferior work are very carefully investigated. A list of members is maintained, with details of the services offered. The current list is appended.

Key to Services Maintained

Still Cameras.		**Other Work**	
Amateur	a	Optical work	g
Focal Plane & Press, etc.	b	Exposure Meters ...	h
Miniature	c	Synchronising ...	i
		Enlarging	j
Cine Work		Binoculars & Microscopes	k
Cameras	d	Electronic Flash repairs	l
Projectors	e		
Sound Units ...	f		

Name	Services
G. Bernard & Co., 24, Victoria Road, Ruislip, Middx.	a b c d e f g i j k l
D. Binns, 61, Poplar Close, Beamley, Leeds	a b c d e f g h i j k l

Name	Services
Bournemouth Photographic Services Ltd., 237, Capstone Road, Charminster, Bournemouth	a b c d e f g i j
Bowen's Camera Repair Service Ltd., 3, Albemarle Way, London, E.C.1.	a b c g h i j k l
Burgess, Lane & Co., Sunleigh Works, Sunleigh Road, Wembley, Middlesex	c d e f k
Eric Clulow, 10, Charnwood Road, Gatley, Cheshire ...	a b c d e f g h i j k l
Essex Camera Repairs, 7, West Road, Westcliff on-Sea, Essex	a b c d e f g h i j k l
Cousins, Wright & Cousins, Yerbury Mills, Trowbridge, Wilts.	a b c d e g h i j k
Donvin Instruments Ltd., 91, Princedale Rd., Notting Hill, London, W.11	h
Dumar Optics Ltd., 13, Mill Hill Road, Acton, London, W.3	a b c d e g h i j
Edmonds & Son, 179a, St. Ann's Road, Tottenham, London, N.15	a b c
Ellis & Newton Ltd., 15, Carlisle Street, London W.1 ...	a b c d e g i j k
E. W. Photographic Service, 100/100a, Selby Road, Leytonstone, London, E.11	a h c d i j
H. A. Garrett, 4a, Grove Road, Sutton, Surrey ...	a b c d e i j k
F. W. Haines Ltd., Park Buildings, Portland St., Swansea	a b c e f i j l
J. & M. Hutchinson, 39, Hope Street, Glasgow, C.2 ...	a b c d e f i j
J. B. Johnson, 226, Eccles New Rd., Weaste, Salford. 5	a b c d e f i
F. P. Jones, 108, Syke Road, Rochdale	a b c d e i j
K. & D. Repair Service, 247, West End Lane, London, N.W.6	a b c d e f g h i j k l
S. W. Komlosy, 181, Victoria Street, Dunstable, Beds.	a h c d e g h i j k l
Leicester Camera & Optical Repair Co., The Crescent, King Street, Leicester	a b c d g h i k l
"M. & P. (Cameras) Ltd.," 34, Burnaby St., Chelsea, London, S.W.10	a b c d e f g h i j k
V. P. Major & Co., 8, Henrietta Place, London, W.1 ...	a b c d g h i k
M.E.F. Repairs, 4, Reddington Gardens, Hampstead, London, N.W.3. ... :	a b c d e f i j l
Midland Camera Repair Service, 50. Clarendon Avenue, Leamington Spa	a b c d e i j
Hugh Miller, 3, Peterborough Mews, Parsons Green, London, S.W.6...	a b c g h i k l
Optical & Mechanical Instruments Co., 157, Camberwell Road, London, S.E.5	a b c d e f g h i j k
Peeling & Van Neck Ltd., 4/6, Holborn Circus, London, E.C.1	a b c g k
Powelmann Optical & Precision Instruments Ltd., 8, Grimsby Road, Cleethorpes, Lincs.	a b c g h i j k
Peter G. Rabjohn & Co. Ltd., 69, Manor Park Road, Harlesden, London, N.W.10	a b c d e f h i j k
Arthur Readman & Sons, 3, Park Street, Market Place, Stockport, Cheshire	a b c d e i j k
D. Samson, 124, St. John St., Clerkenwell, London, E.C.1	h
Scientific Repair Service, Focal Works, Station Parade, Elmers End, Beckenham, Kent	a b c d e h i j k l
Technica Camera Ltd., 21, William IV Street, London, W.C.2	b c d e h i
Technical Precision Co., 13/13b, Perry Road, Bristol, 1.	a b c d e f g h i j k
Clement Wain Ltd., 17, Red Lion Square, Newcastle, Staffs.	a b c i
Colin Waudby & Co., 55, Cockrane St., Glasgow, C.1	a b c d e f h i j k l
D. G. Wise, 28, Oldridge Road, Balham, London, S.W.12	a c e g i
Youngs & Pepper, 202a, Winchester Road, Highams Park, London, E.4	a b c d e i j

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They are supplied in satin-chrome mountings, fitted with positive click-stop iris diaphragms which are scaled in exposure stop markings. The iris operating ring is extended prominently to facilitate dark room operation.

Lens	Aperture	Plate covered at full aperture. in.	Plate covered at full aperture. mm.	Focus rom Flange Screw at infinity.	R.P.S. Flange Screw thread
50 mm.	f/3·5	1 × 1½	24 × 36	1·8-in.	1¼-in.
80 mm.	f/4·5	2¼ × 2¼	60 × 60	2·8-in.	1¼-in.
108 mm.	f/4·5	2½ × 3½	65 × 90	3·8-in.	1½-in.
5-in.	f/4·5	3¼ × 4¼	80 × 110	4·6-in.	1½-in.

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The crisp overall definition of Aviar lenses, makes them prized amongst professional and amateur photographers as the finest anastigmats ever produced in any country, and they are eminently suitable either for monochrome or for the production of colour transparencies.

Series II f/4·5 and IIIB f/6 "AVIAR"

Lens	Approximate Equivalent Focus		Plate covered at Full Aperture		R.P.S. Standard Flange Screw in inches	
	in.	mm.	in.	cm.	Standard mount.	Sunk mount.
	6	152	5 × 4	9 × 12	1¾	—
	7	178	6 × 4	10 × 15	1¾	—
	8¼	210	6½ × 4¾	12 × 16	2¼	2½
Series	10	254	6½ × 4¾	12 × 16	2¾	—
II f/4·5	12½	320	9 × 7	17·5 × 23	3½	—
	13½	342	10 × 8	20 × 25·5	3½	—
	8½	216	6½ × 4¾	12 × 16	1¾	—
Series	10½	270	8½ × 6½	16·5 × 21·5	2¼	—
IIIB f/6	12½	320	10 × 8	20 × 25·5	3	—
	15	380	12 × 10	24 × 30	3½	—

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WIDE ANGLE LENSES *Series* VIIB f/6.5

Architectural and similar subjects—both indoors and out—call for the wide angle lens that will produce fine detail over the whole of the negative area, and it is then that the discriminating photographer turns confidently to his Taylor-Hobson Series VIIB ' Eistal '.

A full aperture of f/6.5 is provided for focusing and composition of picture—a feature of especial value when working in dim interiors. Subsequent stopping down for exposures is then effected without refocusing. The angle of view is 90° at f/16 and 100° at f/32.

Series VIIB f/6·5 WIDE ANGLE

Approximate Equivalent Focus		Plate covered at f/16		R.P.S. Standard flange screw in inches
in.	mm.	in.	cm.	
3¼	82	5×4	9×12	1¼
4¼	108	7×5	13×18	1¼
5¼	133	8½×6½	16·5×21·5	1¼
6¼	158	10×8	20×25·5	1½
8	203	12×10	24×30	1¾

Surface Coating of Lenses

To ensure maximum light transmission and contrast values, the air-to-glass surfaces of all Taylor-Hobson lenses are provided with a hard, durable coating which will withstand all the normal cleaning processes which apply to uncoated lenses.

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TAYLOR-HOBSON

COOKE PORTRAIT LENSES

Series IIE f/4.5 PORTRELLIC

Cooke Portrait lenses are anastigmats of the highest grade, capable of giving needle-sharp definition, or by means of control over spherical aberration, a definite degree of diffusion can be introduced to give a soft-focus effect when desired, which can be repeated accurately at any time.

The diffusion adjustment is effected simply by turning the finger-grip on the lens mount, while a bold and easily read scale indicates the degree of diffusion introduced.

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Series IIE, f/4·5, PORTRELLIC

Approximate Equivalent Focus		Plate covered at Full Aperture		R.P.S. Standard Flange Screw in inches
in.	mm.	in.	cm.	
10½	270	8 × 5	12 × 20	2¾
12¾	325	9 × 7	17·5 × 23	3½
15	380	10 × 8	20 × 25·5	4½
18	460	12 × 10	24 × 30	5
20	508	15 × 12	30 × 38	5

The full-range of Taylor-Hobson lenses for still photography includes a number of types in addition to those described in these pages and information concerning them can be obtained upon request.

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(See p. 71 of 1951 B.J. Almanac).

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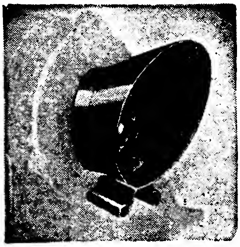

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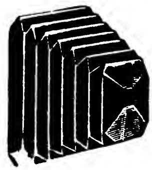

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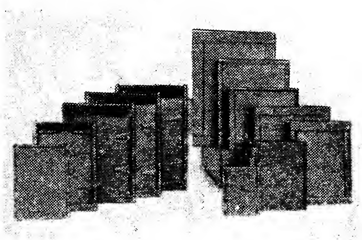

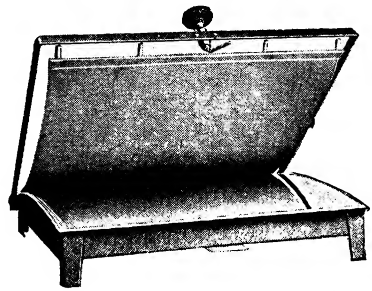

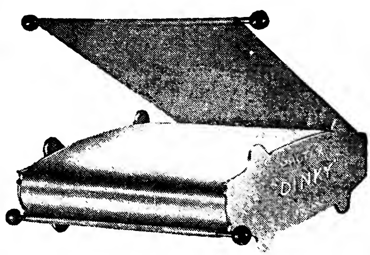

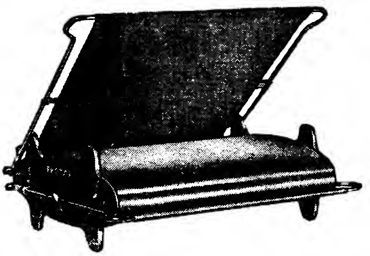

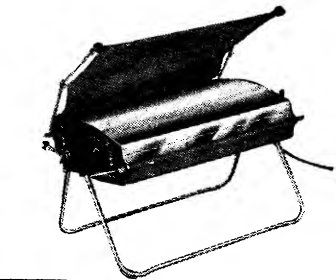

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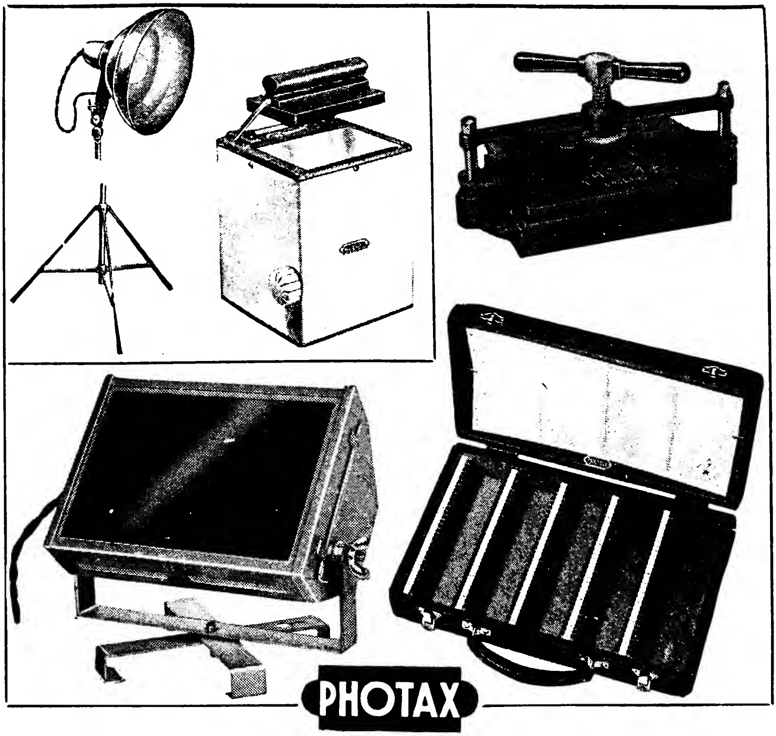

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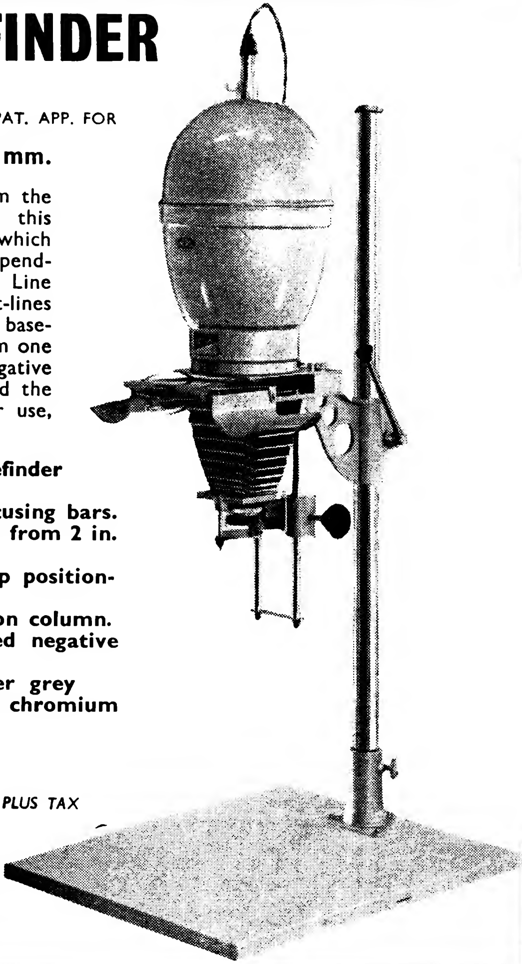

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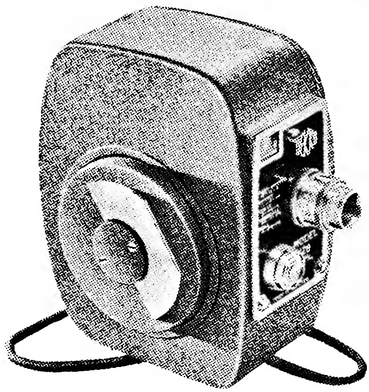

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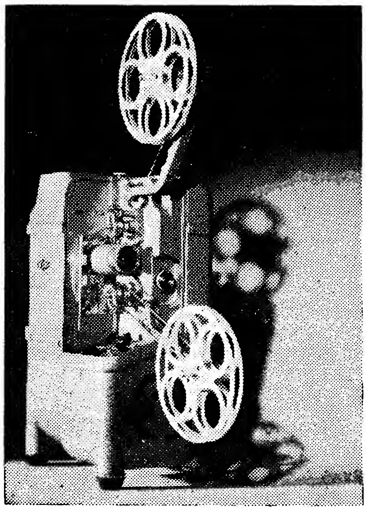

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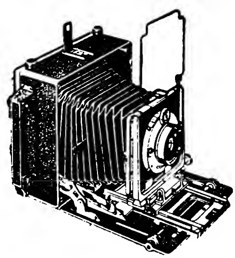

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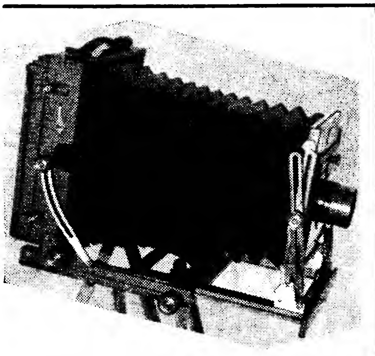

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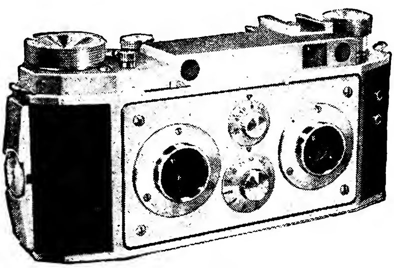

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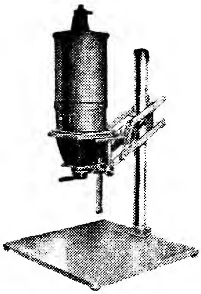

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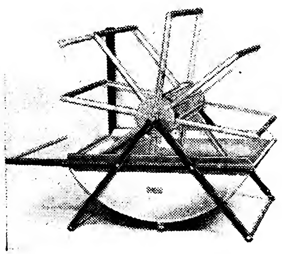

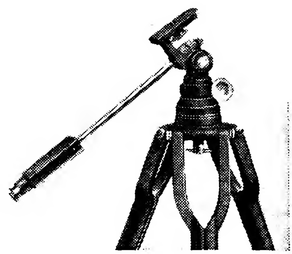

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Heavy-duty, all-metal type. Precision made for the Professional or serious Amateur 16-mm. user.

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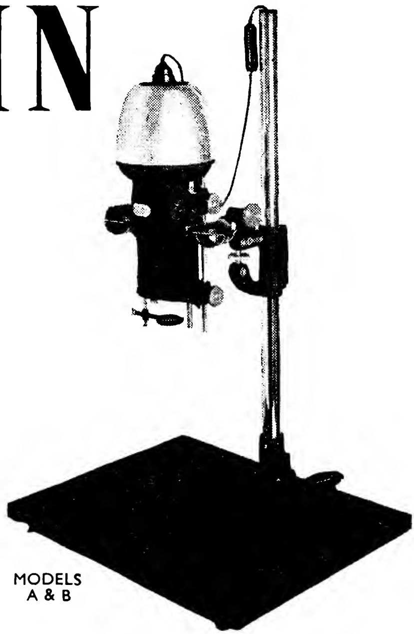
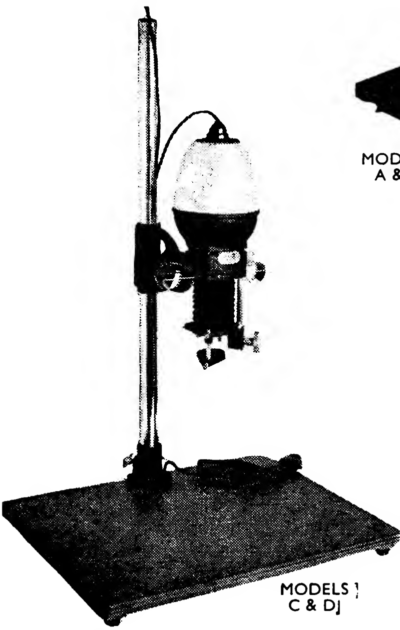


MODELS
A & B



MODELS
C & D

The Pullin range of precision built Enlargers is represented by two models for negatives up to $2\frac{1}{4} \times 2\frac{1}{4}$ in. and two for 35-mm. negatives. An efficient condenser system in each model ensures even illumination and the negatives are firmly held in the focal plane by glassless negative carriers.

Focusing in each case is by bellows extension regulated by a rack and pinion movement. Models A and B for negatives up to $2\frac{1}{4}$ x $2\frac{1}{4}$-in. and Models C and D for 35-mm. negatives.

PULLIN OPTICS

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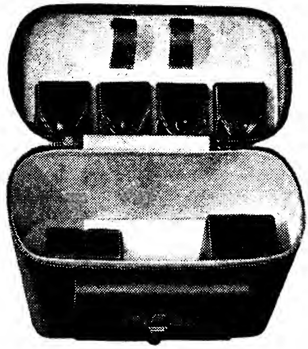
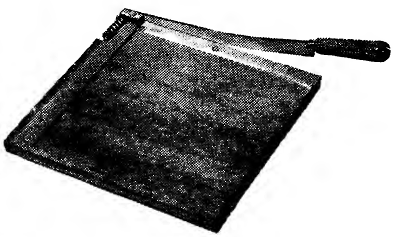
Accessories that are different

Pullin photographic accessories of every type are well known for their high standard of quality and workmanship and those illustrated represent only a selection of a wide range of photographic aids for the photographer covering Dark-room Accessories, Colour Filters, Water and Solution Filters, Hold-Alls, Camera Cases, Albums, Tripods and Camera Accessories.



PULLIN CASES

Only the best British materials are used in the manufacture of a wide range of Hold-Alls, leather and waterproof camera, exposure meter and tripod cases.



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A comprehensive series of trimmers with 6-in., 7-in., 9-in. and 11-in. cut for the amateur or professional worker. Only the best quality materials have been used to ensure ease of use and long life.

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This well known range of telescopic tripods is distributed in Great Britain by the Pullin Optical Co. Ltd. They are available with flat or round heads, and made from brass or dural light metal with three to ten sections. Each tripod is fitted with a reversible English and Continental camera retaining screw.

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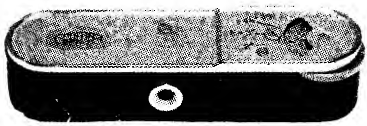
A precision made high-grade measuring instrument, employing the "Swing-Wedge" principle, two fixed spring-retained prisms forming the optical base of the instrument. The movement of the swing-wedge is four times greater than that of a rotating mirror would be for the same distance measurement.



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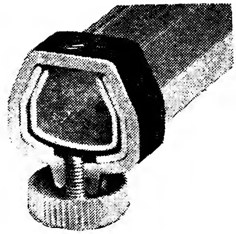
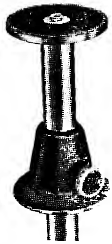
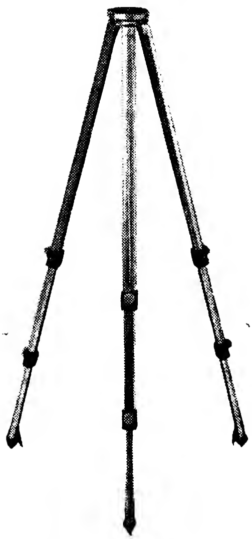
Schiansky Profile Tripods

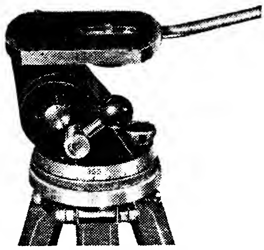




Made in dural profile, maximum stability is ensured whilst being extra light in weight. The legs are in three sections and provided with an alternative choice of spiked or rubber feet with additional offset spikes for wide splay. The tubular extension illustrated available as an extra accessory, increases the height of the tripod extended from 5-ft. $2\frac{1}{4}$-in. to 6-ft. 10-in.



The Pan and Tilt Head and Swivel Ball and Socket Heads are beautifully constructed pieces of equipment with engraved panning scales.
Both English and Continental camera retaining screws are provided.



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of MUNICH
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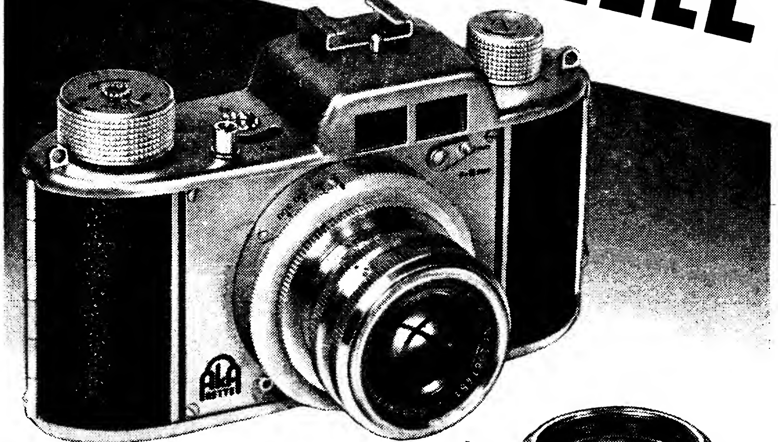
AKARELLE



with interchangeable lenses

Limited supplies of these high grade miniature cameras are now being imported. The comparatively few fortunate and justly proud British owners of Akarelles are full of praise for these delightful instruments. Ask your Dealer for particulars.

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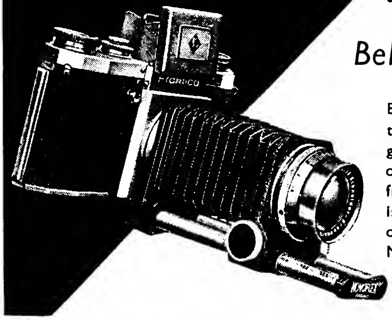

Bring new ease and accuracy to technica! and scientific photography. Any intermediate ratio of magnification or diminution from infinity to extreme close-ups, is obtained, without blind spots or restriction of focussing range. No tubes to change, no reflections, no loss of time at the crucial moment.

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Used with Novoflex Bel.ows this incomparable combination opens new horizons to owners of Leica, Reid, Exakta, Practika, Praktiflex, Contax D, Pentacon, Master Reflex, Primarflex, Hasselblad, etc.

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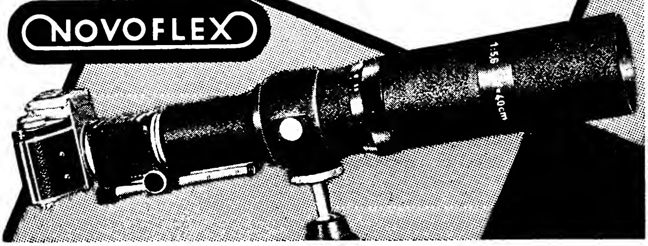

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* Instantaneous trouble-free slide changing.
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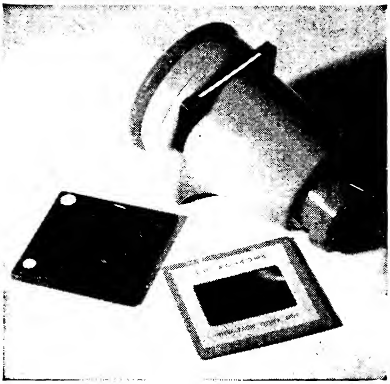

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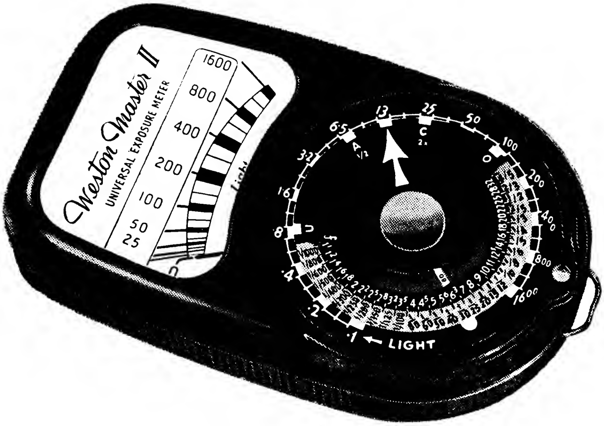

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Ciné version also available at the same price.

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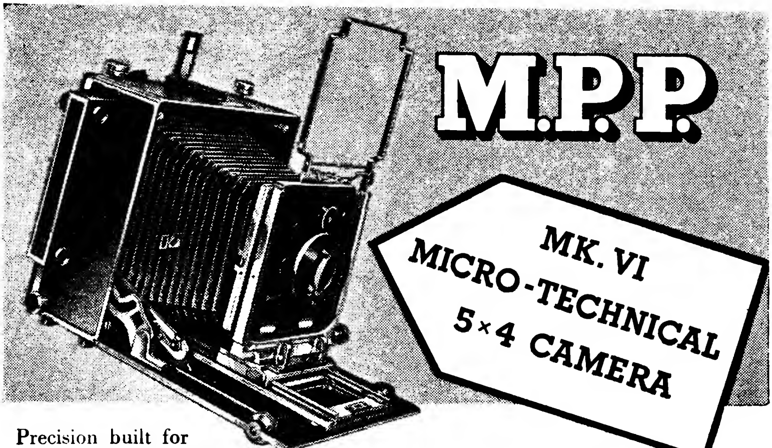

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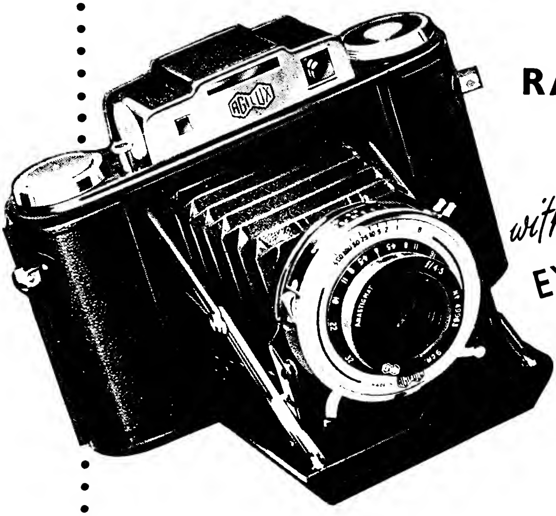

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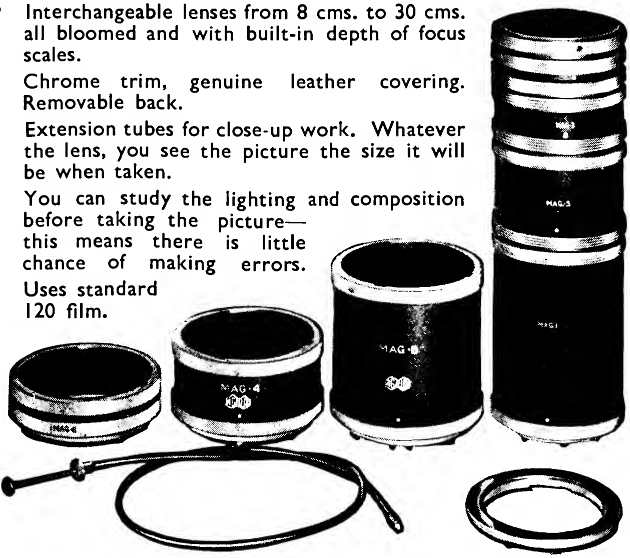

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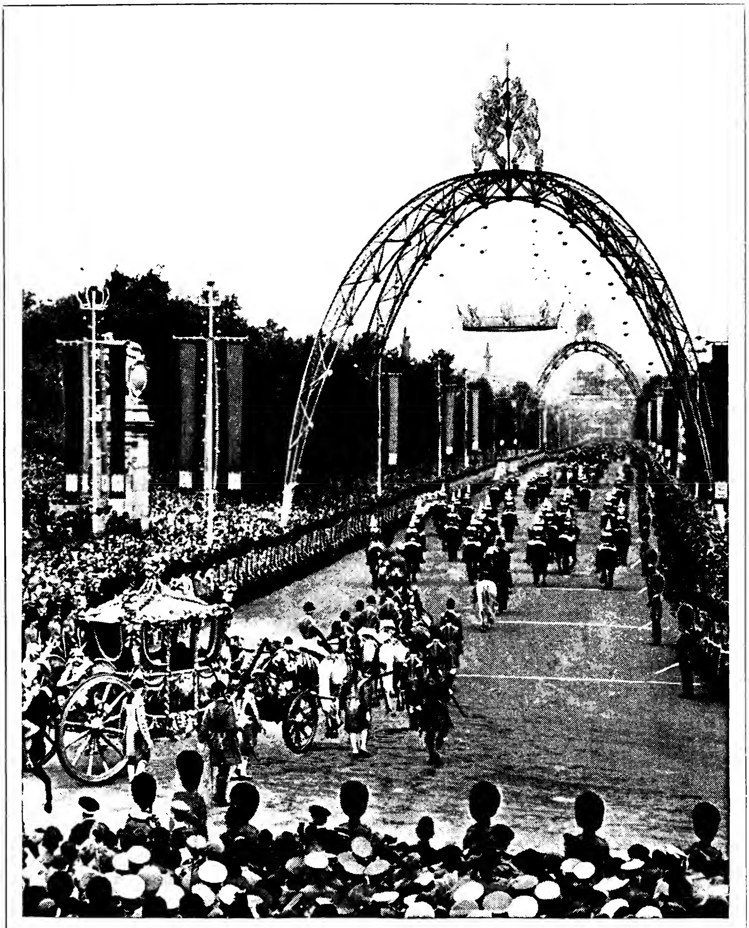
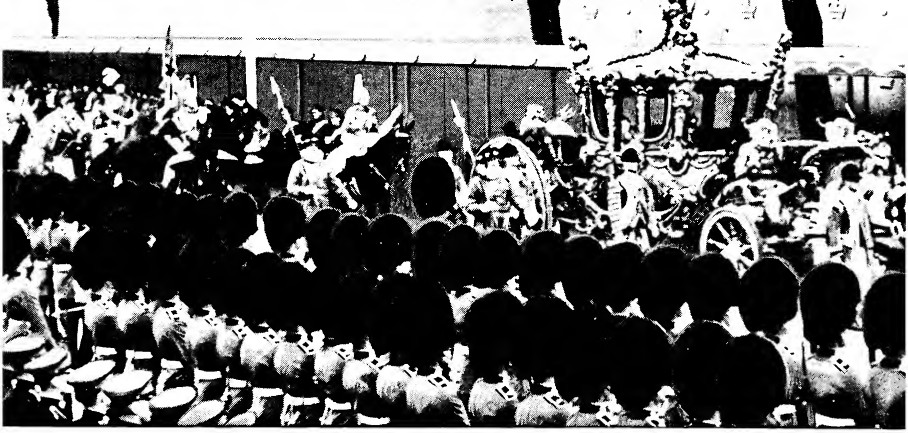


A FOX PHOTO

— the Coronation. And 'Amfix' brand ultra-rapid fixer played a valuable part. Fox Photos Ltd. used it for their negatives and prints throughout the Coronation period, and its speed and convenience enabled London evening newspapers to get their pictures into the early editions.



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trade mark brand

Developer tins to make 600 c.c., 2½ litres (88 fl. oz.) and 13½ litres (3 gallons) working solution.
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A Special Hardener is available for use with 'Amfix'

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Special Hardener in bottles of 1 fl. oz. **Fixer Concentrate** in bottles of 10 fl. oz. Fixer also in bottles of 80 fl. oz. and demijohns of 5 gallons; hardener in bottles of 8 and 80 fl. oz.

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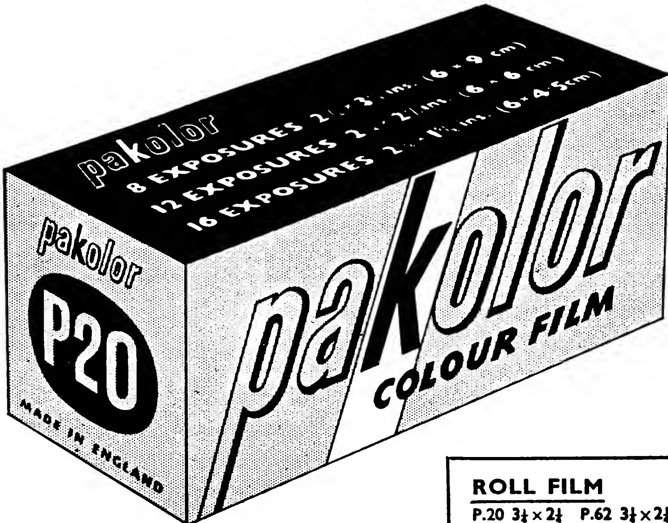

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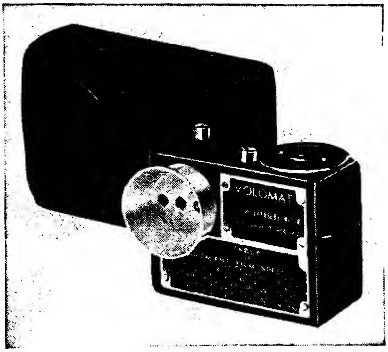

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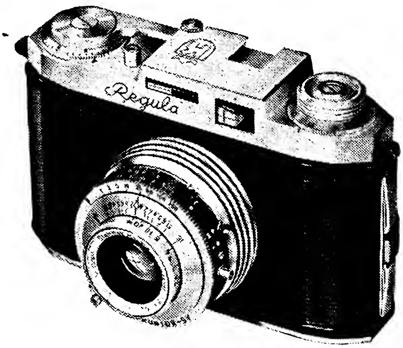

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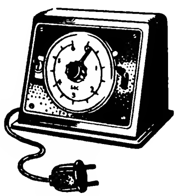

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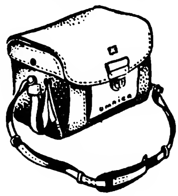

In quality of material and craftsmanship these holdalls have no equal. They are made to suit the connoisseur.

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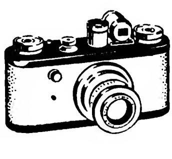
An inexpensive 35 mm. precision camera having many features normally found only on much higher priced equipment.



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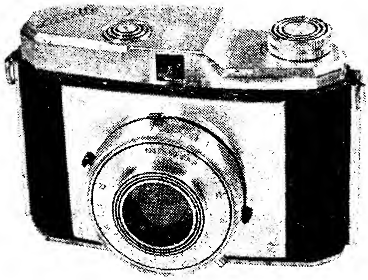

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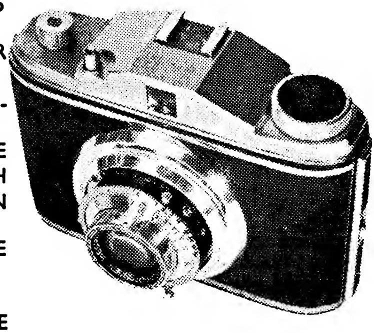

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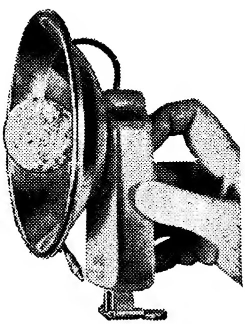

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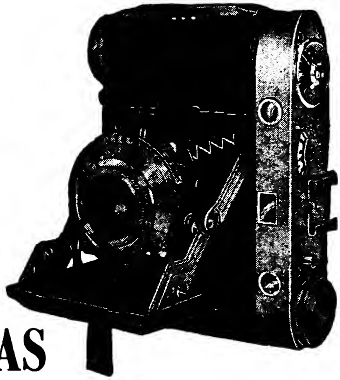

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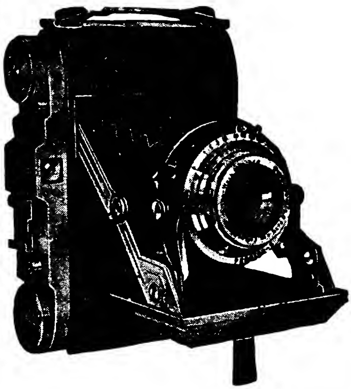

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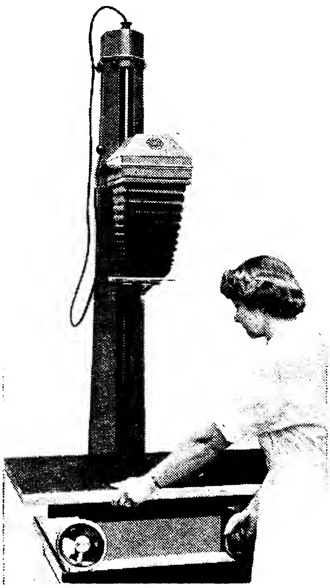

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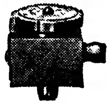

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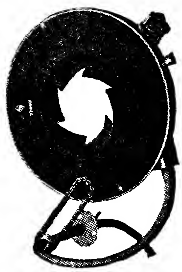

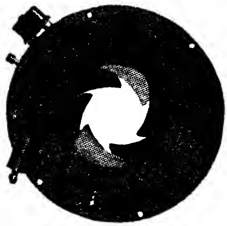

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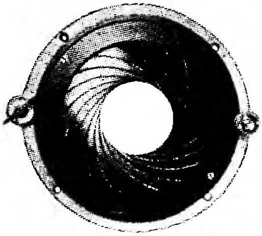

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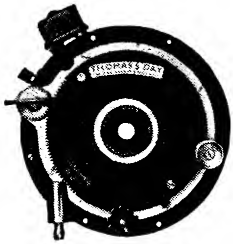

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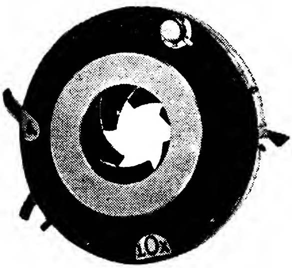

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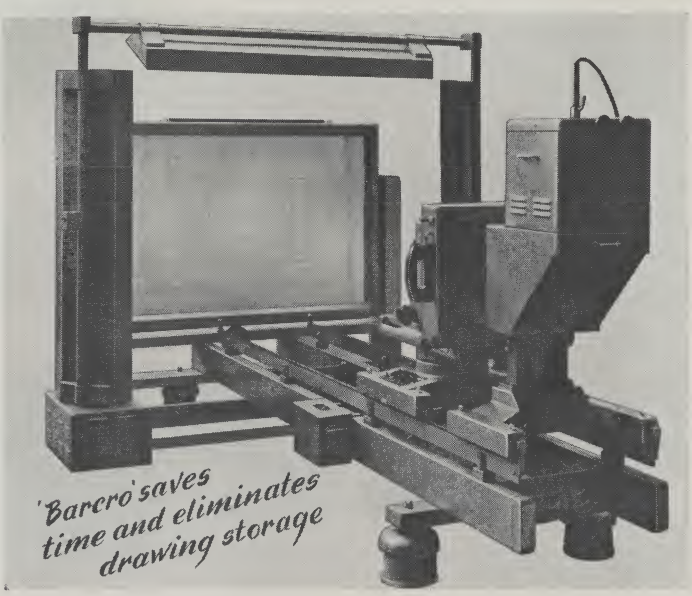

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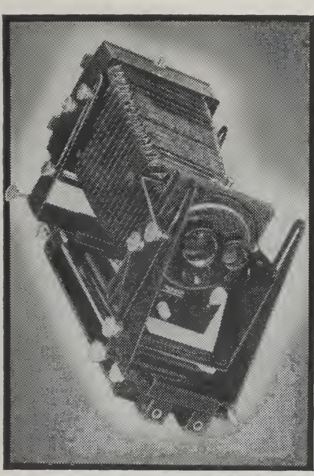

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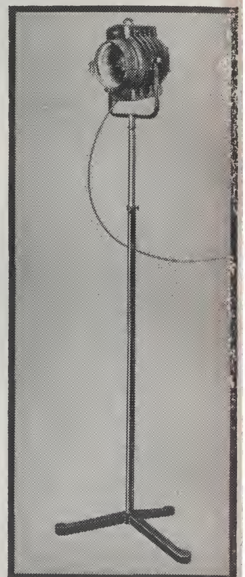

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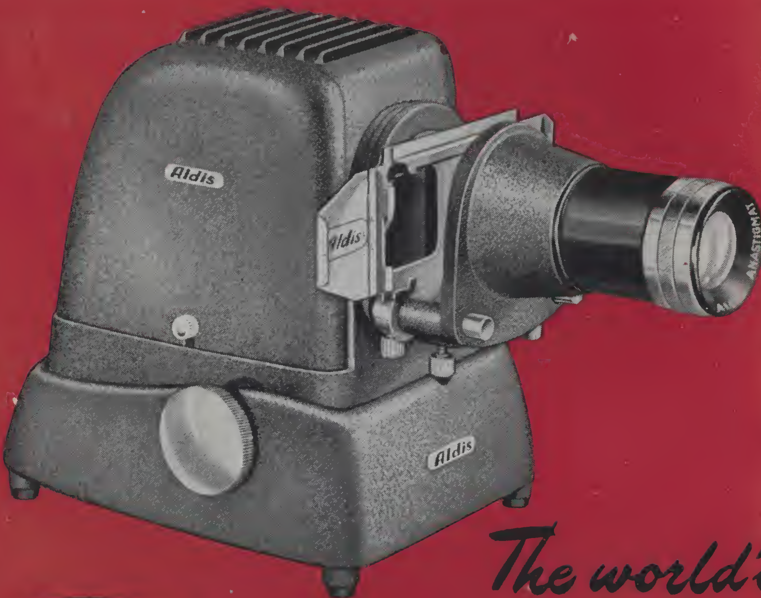

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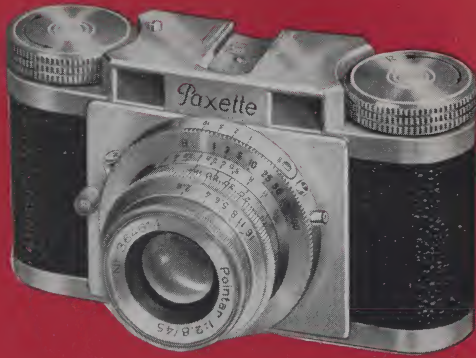

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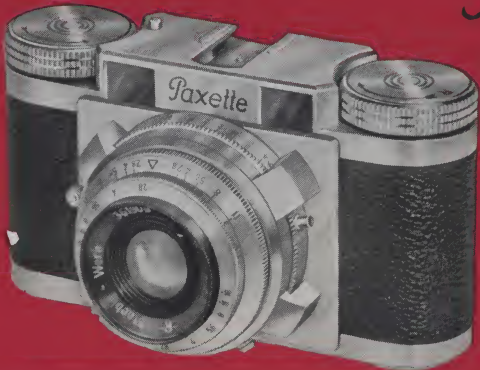

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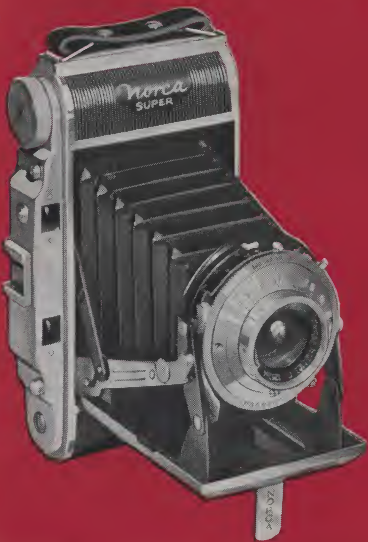

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NORCA All five cameras in this range take 8 or 12 pictures on 20 film. They embody the most up-to-date features including all-metal body ; self-erecting front ; body release ; flash synchronised shutter ; sliding red window cover ; rangefinder shoe ; tripod bush ; cable release socket ; leather bellows and handle. There is a Norca camera to suit your pocket.

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GEVACOLOR

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GEVAPAN 27 Microgran. Extremely fine grain panchromatic of medium speed. Bright gradation and great wealth of detail. Superb tone rendering for pictorial work. Available in roll film, miniature film, flat film.

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Gevacolor

Gevacolor Negative N5—This film (roll and miniature) for daylight photography, gives colour negatives intended for printing and enlarging on Gevacolor paper.

Gevacolor Paper—This colour paper is intended for making prints and enlargements from colour negatives on Gevacolor Negative film. This paper is supplied only to authorised Gevaert laboratories.

Gevacolor Reversal R5—Reversal film (roll and miniature) for daylight photography, giving direct transparencies in natural colours, intended for projection.

Gevacolor Reversal R3—This reversal film (miniature and flat films) for exposures with overrun lamps with a colour temperature of 3200°K, gives direct transparencies in natural colours.

Gevacolor Reversal Processing Kit (powder)—Contains all the necessary baths for the processing of Gevacolor Reversal Flat Film.

Gevacolor Negative Type 651—35 mm—A professional colour cine film intended for picture taking, giving negatives in complementary colours for printing in natural colours on Gevacolor Positive Type 951.

Gevacolor Positive Type 951—35 and 16 mm—A professional colour cine film intended for printing release copies from Gevacolor Negative Type 651.

Gevacolor Filters—CT-Filters: intended for compensating deviations from the colour temperature. **UV-Filters:** absorb the excess of ultra-violet rays. **CC-Filters:** eliminate colour casts in the production of colour positives on film or paper.

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From the outset Lieven Gevaert devoted himself to manufacturing quality products to meet the ever-growing demand as new uses and applications arose in the fields of photography and cinematography.

This insistence upon quality, eagerly sought by discriminating buyers, has to-day placed the Gevaert organisation in the forefront of the world's trade markets.

Every day Gevaert craftsmen and technicians excel themselves in attaining new standards of quality and efficiency in production. Output is to-day more than three times that of pre-war.

With the expansion of photography during the last two decades into ever broadening phases of human activity, the photographic manufacturer has been faced with the necessity of solving problems as complicated as they are diverse.

The painstaking research in the Gevaert laboratories is constantly solving these problems and creating materials for wider applications and new uses, thus maintaining a sixty years' record of service to photography and its benefit to mankind.

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LENSES

Established in the same year as Fox-Talbot first brought photography into practical being, the House of Wray has followed the development of the photographic lens to its present position as one of Britain's leading manufacturers. The SUPAR Enlarging Anastigmat has become the World's most widely used lens in the dark room. Most of the leading manufacturers of Enlargers fit SUPAR lenses as standard.

The f/4·5 LUSTRAR, a famous name associated with Wray for half a century. A 4-element lens of very thin components, giving a remarkable brilliance of image. It is most accurately corrected for all aberrations over the entire field, and is available in focal lengths from $5\frac{3}{8}''$ to $15''$. In Iris Mount or Shutter.

The 8″ f/8 "H.R." Copying Lens has been designed primarily for "high resolution" copying and enlarging, but is eminently suitable for studio work which calls for a degree of precision not normally to be found in a standard anastigmat. This lens is available in Iris Mount or 8 speed shutter.

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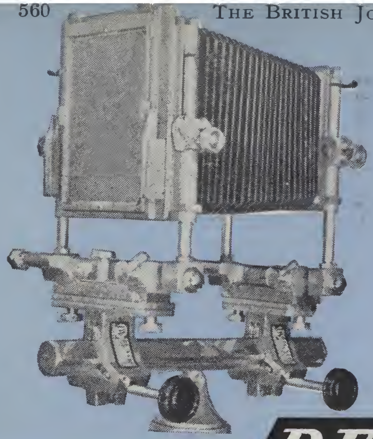

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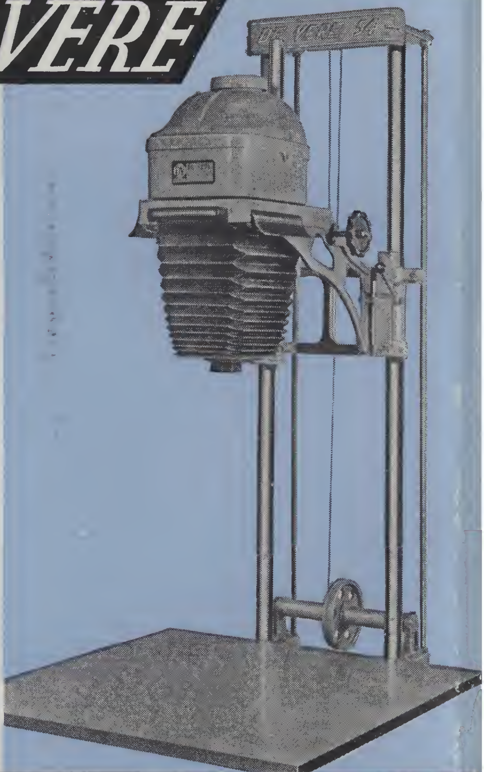

The Multipurpose CAMERA

This camera is built on an extruded 4-track bed which provides unusual rigidity for a monorail type camera. The back and front units run on multiple ball races which give perfect control over focussing movement. Every essential movement of both back and front is provided and there is a really positive lock in any position. Lenses and bellows can be very easily interchanged by means of quick release devices.

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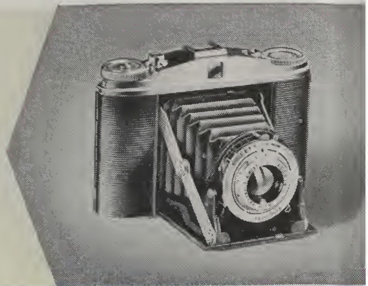

ISOLETTE II

$2\frac{1}{4} \times 2\frac{1}{4}$ f4.5/85 mm coated, fully corrected Anastigmat lens. Synchronised for flash. Body release. Double exposure prevention device. Depth of field scale.

Three models available

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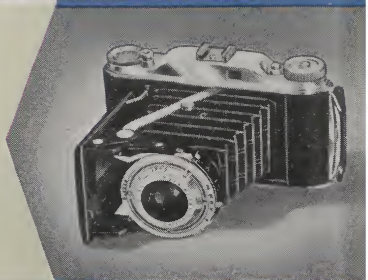

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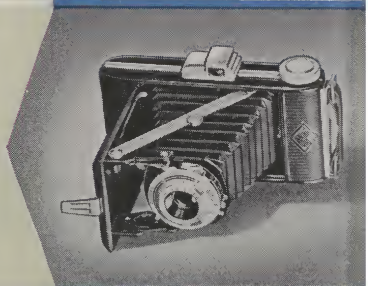

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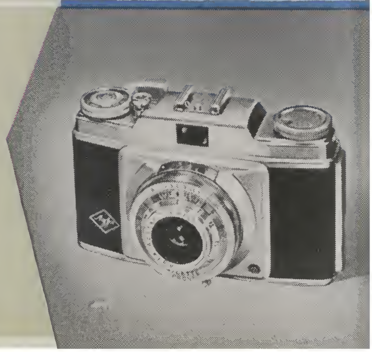

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35-mm miniature Camera. Apotar f3.5/45 mm coated, fully colour corrected Anastigmat lens. Rapid lever wind for transporting film and automatic setting of shutter. Double exposure prevention device. Depth of field scale. Automatic exposure counter indicator. Body release with cable release socket. Built-in eye-level optical finder. Accessory shoe.

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accessories

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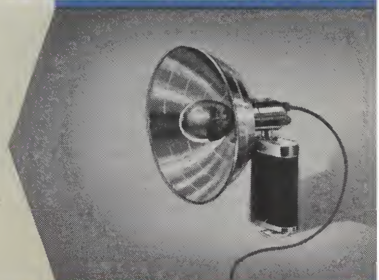
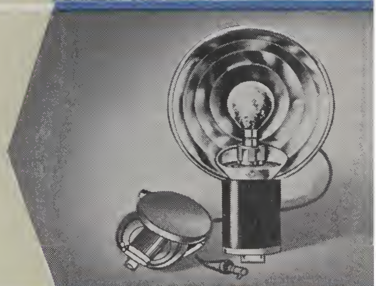


Ref. No. 6820. This capacitor flash gun also uses the standard 22½-volt hearing aid battery and takes all the standard flash bulbs with the A.S.C.C. fitting. A bulb ejector is fitted for the removal of the used lamps. The testing device which is built into the circuit, enables you to check the capacitor, the battery, the flash bulb and the shutter synchronisation. The revolving head enables you to direct the angle of light for special effects, etc.

FLASH GUN KL



Ref. No. 6821. This flash gun has a built-in capacitor, which uses the 22½-volt hearing aid battery. The capacitor ensures accurate firing, even with near exhausted batteries. The battery case and flash lead fit neatly into the reflector when not in use and the whole unit packs away in an attractive zip fastener case. Suitable for use with all cameras having the standard 3 mm synchronising plug and takes all flash bulbs with the A.S.C.C. fitting.

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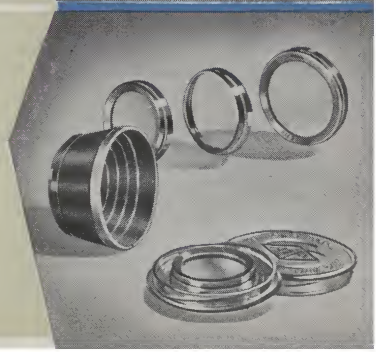

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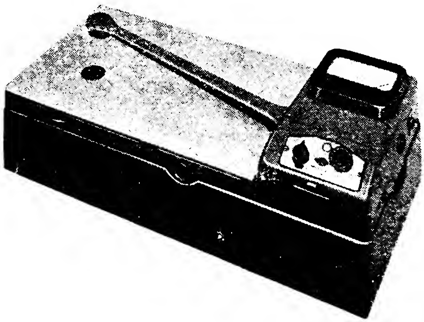

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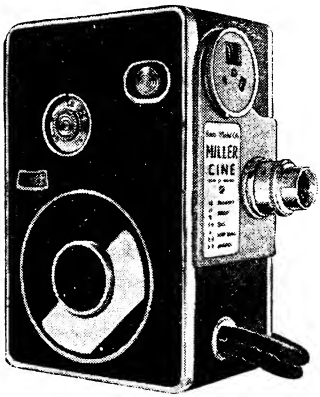

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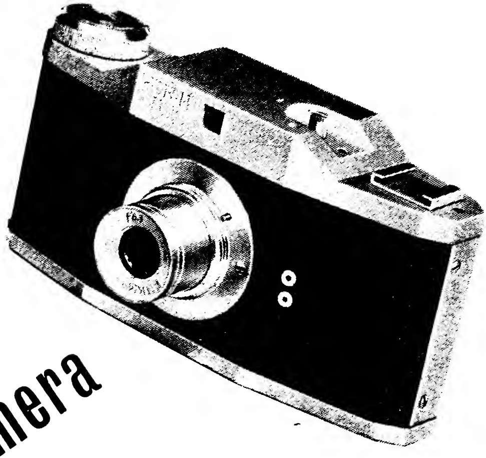

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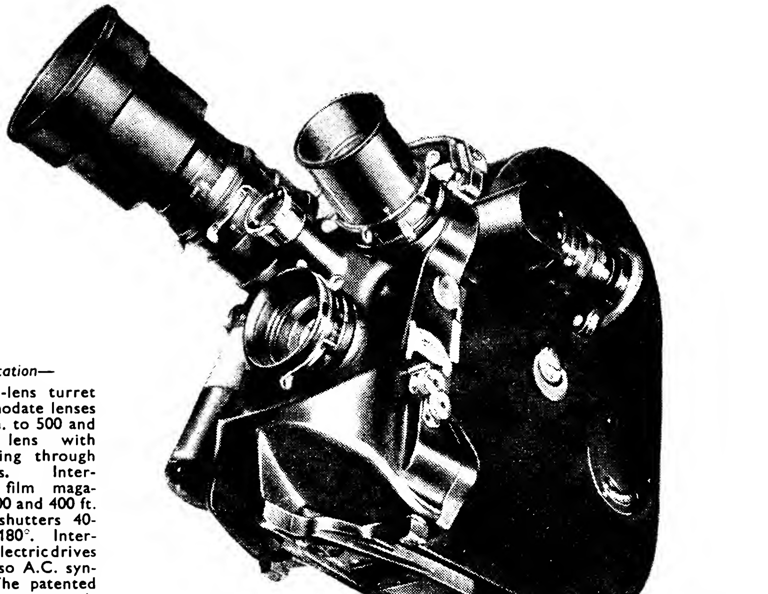

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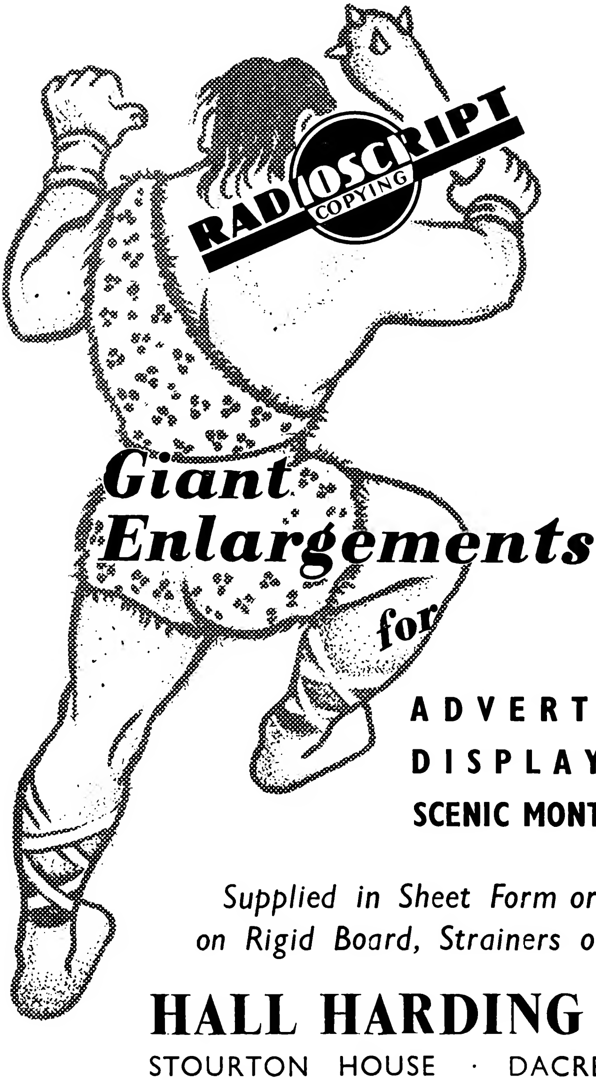

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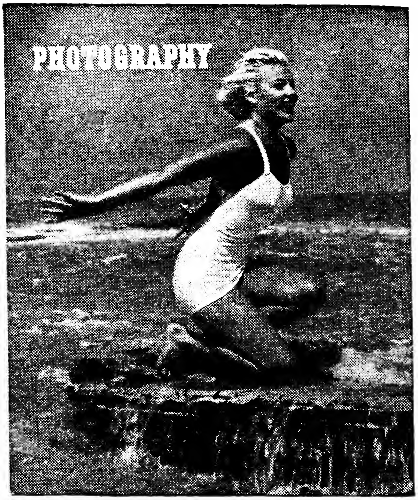

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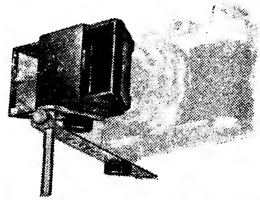

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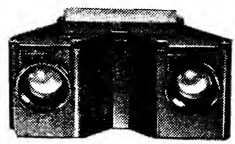

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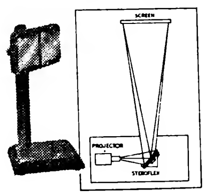

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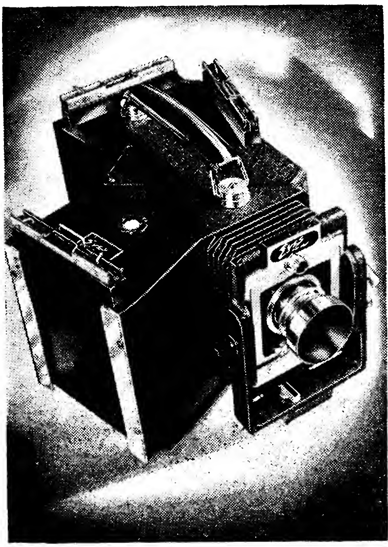

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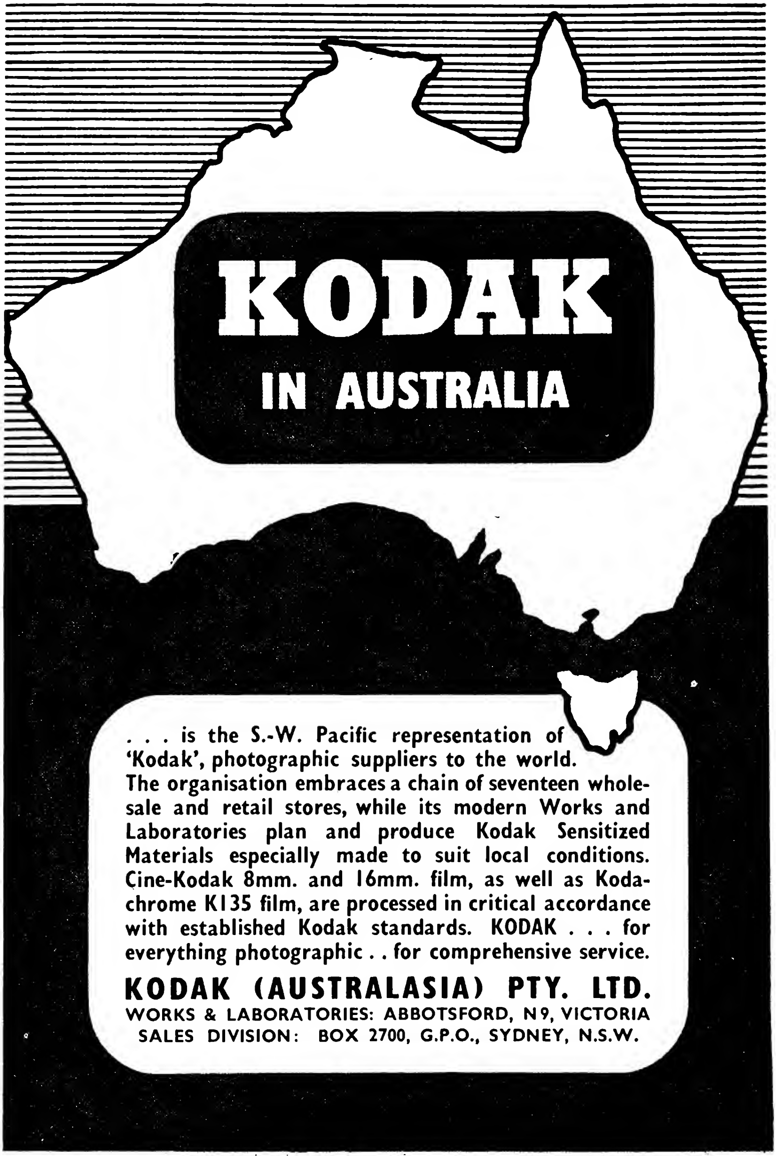
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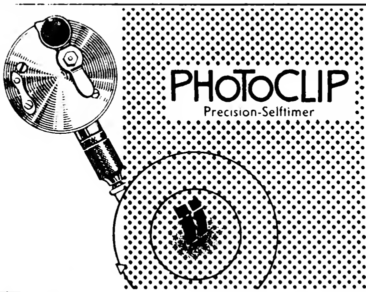

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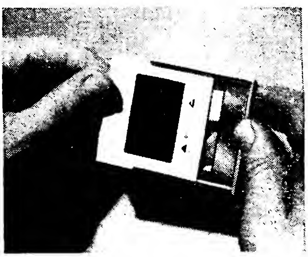

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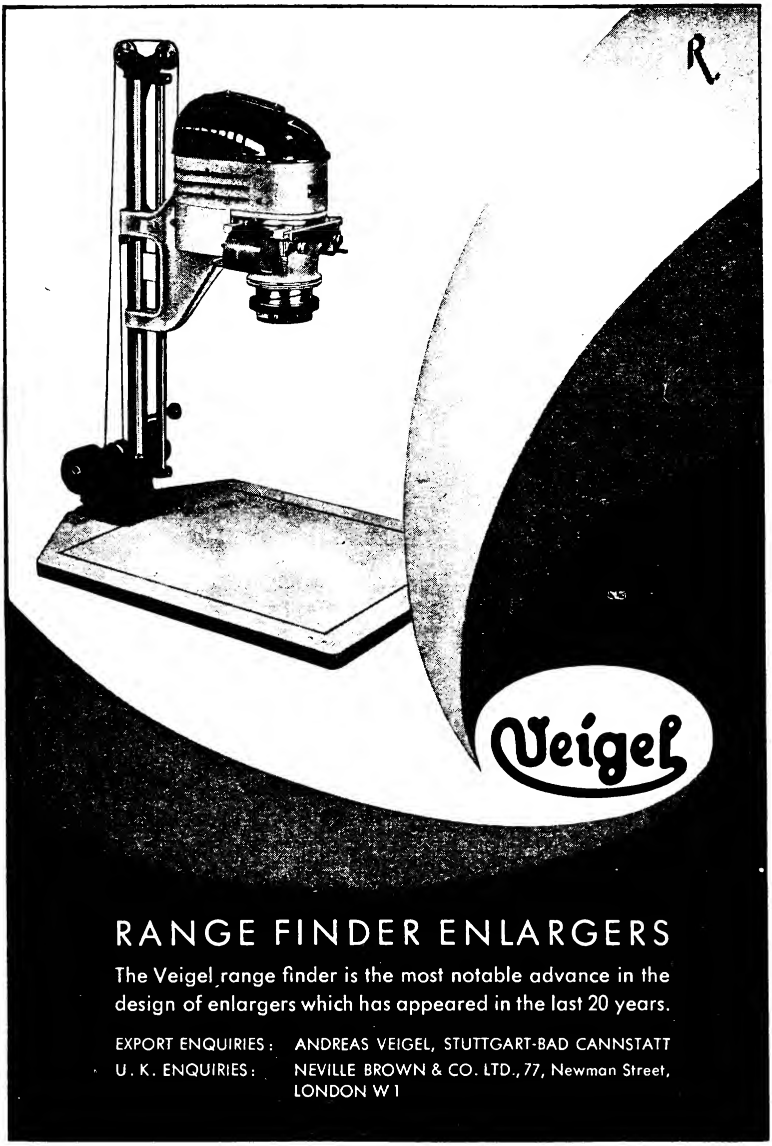
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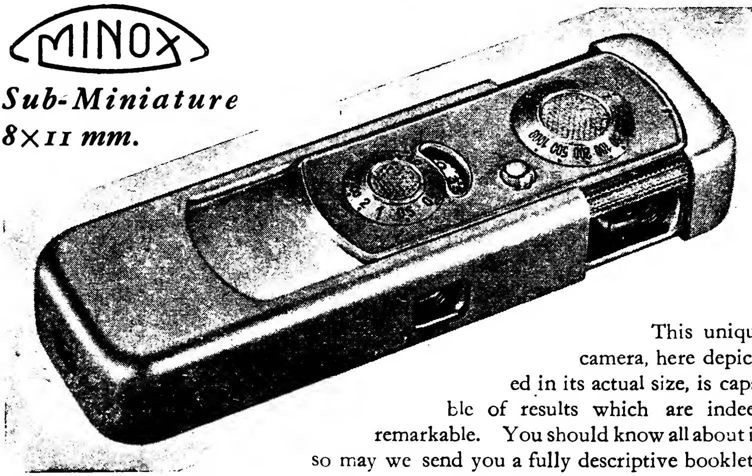

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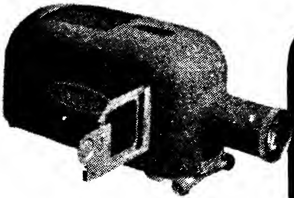

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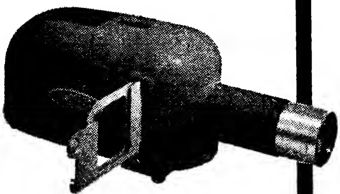

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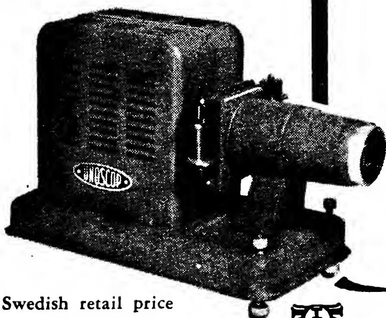

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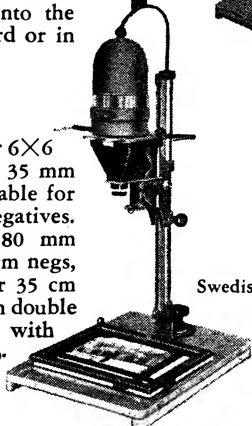

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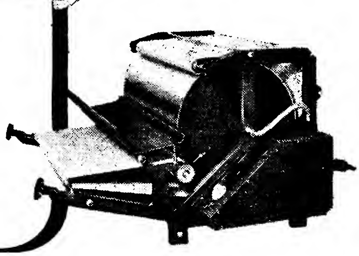

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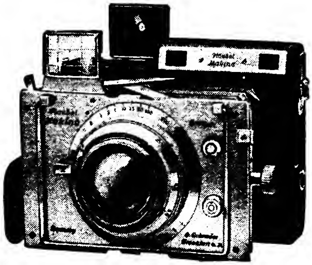

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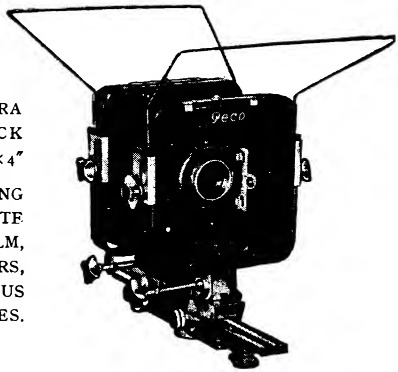

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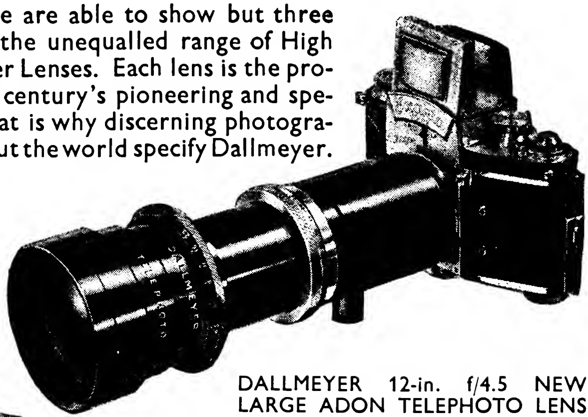

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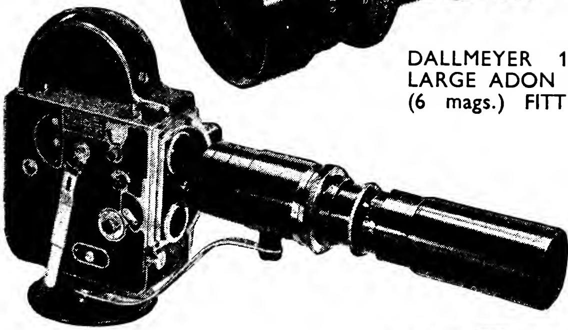

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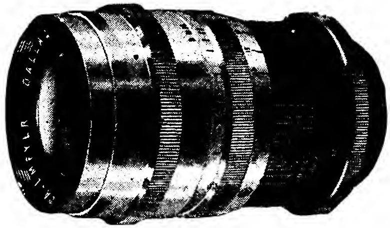

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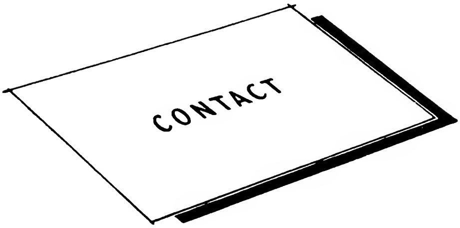
The arrangement of the text is shown by the Table of Contents on pages 95-96. For definition of photographic terms see Glossary on pages 254-262.

CLASSIFIED INDEX TO GOODS ADVERTISED

INDEX TO ADVERTISERS



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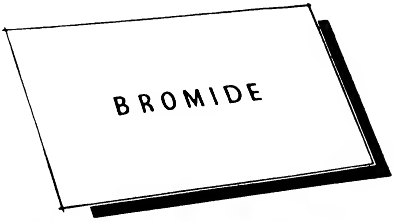

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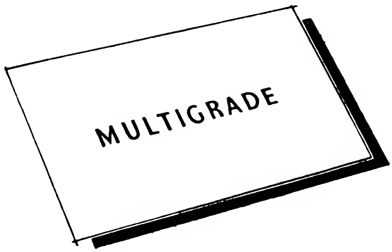

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